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THE MEDICAL DEPARTMENT OF THE NAVY



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CAPTAIN W. CHAMBERS, MEDICAL CORPS, U. S. NAVY
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Edited by

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes, and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit and will recommend that copies of such letters be made a part of the official records of the officers concerned.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,
Surgeon General United States Navy.

NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated, if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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SPECIAL ARTICLES

REPORT ON RELIEF WORK IN THE SANTO DOMINGO DISASTER

By LUCIUS W. JOHNSON, Commander, Medical Corps, United States Navy

On September 2, 1930, the city of Santo Domingo, Dominican Republic, was visited by a hurricane. The storm had been observed for several days and was expected to pass south of Haiti but it took a sudden right-angle turn to the north. About noon it began with a strong wind and much rain, increasing in violence until about 2 o'clock, when it reached its greatest intensity. Estimates of the velocity of the wind varied greatly, but I was reliably informed that the anemometer at the aviation field registered 160 miles per hour before it was blown away. The wind came from the north and about 3 o'clock it subsided. There was an interval of about 30 minutes of beautifully clear sunshine and everybody came out to see the damage done by the storm. Suddenly the storm came again from the south, almost as violent as at first, and lasted until about 7 p. m., when the wind subsided but a heavy downpour of rain continued until about 9 p. m.

During this interval of about seven hours, 2,000 people were killed, over 7,000 injured, and nearly every residence in the city destroyed. The railway bridges and the roads leading to the city were washed out. A dredge was sunk across the channel so as to block the harbor. The wireless towers were blown down; the submarine cable was disabled so that the city was cut off from the rest of the world. Thus the news of the disaster was slow in spreading. The small short-wave radio set at the aviation field of the Pan-American Airways was the first to inform the world.

Haiti, Porto Rico, and Cuba were the first to start the work of assistance. On September 4, two automobiles started from Port au Prince with surgical supplies from the Haitian General Hospital, in charge of Mr. John T. Lassiter, of the financial adviser's office, and Dr.

Martial Bourand, one of the surgeons from the Haitian General Hospital. The same day an aviator from the Marine Corps squadron at Port au Prince flew over the city but was unable to land because the aviation field was covered with wreckage. On September 5 another flight was made and the field was found to be sufficiently cleared so that landing was possible. The condition of the city and the great need for aid were ascertained.

Through arrangements made by Capt. M. A. Stuart, Medical Corps, United States Navy, and Col. R. M. Cutts, United States Marine Corps, I was given the opportunity to organize a relief expedition, as representing the Haitian Government. On September 6, at 8 a. m., we took off with Marine Corps pilots from Bowen Field, Port au Prince, in seven Vought planes. Doctors Antoni Lévêque, René Nicolas and Constant Pierre-Louis of the Haitian General Hospital accompanied me, the other planes being loaded to capacity with supplies provided by the service d'hygiène and the brigade hospital. As we passed over Azua and Bani we saw many bridges washed away and realized how little chance there was for Mr. Lassiter and Doctor Bourand to get through. All the rivers were over their banks and long stretches of the road were under water.

The sight of Santo Domingo City from the air was most impressive. Nearly every house left standing was unroofed. Great quantities of débris were everywhere, numerous uprooted trees, innumerable sheets of galvanized iron wrapped around poles or trees by the force of the wind, bodies of domestic animals, and a thick network of electric wires over everything. We landed at the airport at 10.15, and there began the most strenuous week of my life. We were met by Mr. David A. Curtis, field manager of the Pan American Airways, who proved to be one of our most active and valuable aids as long as we remained at Santo Domingo. At the airport were two wrecked planes, one a large Ford plane, lying on its back.

I left the Haitian doctors at the field and went into the city, 7 miles away. The road was cleared sufficiently so that a car could get through, but the sides of the road were piled high with all sorts of building material, trees, and other wreckage. The reinforced concrete poles were all down, several of them broken by the impact of flying sheets of galvanized iron or other missiles. Already people were at work everywhere, building shelters even more flimsy than those recently destroyed. As we neared the city, where the houses were closer together, the confusion was even worse. One could ride for blocks and see not a tree or a house left standing and, in the middle of this, a house or two with not even a pane of glass broken. Two palm trees were transfixed, about 25 feet from the ground, one by a piece of 2 by 4 inch and one by a 2 by 6 inch timber. Several

concrete-block houses seemed to have exploded, the blocks flying outward in all directions.

I went directly to Fort Ozama, where President Trujillo had his temporary office, his home and his office having been ruined by the storm. As I entered the President's office I met my old friend, Señor Rafael Brache, Dominican minister to Washington, whom Lieut. Commander Gendreau, Medical Corps, United States Navy, and I had operated on in the naval hospital at Washington. I delivered Colonel Cutts' letter of introduction to the President, and, after these contacts, there was never any doubt that I was among friends. After a few minutes of conversation the President asked me to look over the hospitals and other places where the injured were gathered and see what ought to be done. He gave me his own Packard car, which I used during my whole stay, and detailed Señor Eugenio LaPierretta, Dominican Consul at New York, to stay with me as guide, interpreter, and counsellor. He proved to be a faithful friend, loyal, and a delightful companion.

The condition of the city could hardly be worse. There was no water because a bridge carrying the aqueduct across a ravine had washed out. There was no electric light because all the poles and wires were down and the central generating station was disabled. All the hospitals depended entirely on electric sterilizers, and electric stoves were used for cooking in many homes. There was shortage of food because the roads on which it is brought to the city were impassable. There was shelter for only a few because all the roofs were gone. The churches and other substantial buildings which retained their roofs were crowded with the homeless. Only a few had beds or bedding and many were entirely naked. This would not be so noticeable in this country, except that it was the rainy season and heavy downpours were frequent. All sewers were blocked for four days and everybody had been using any dark corner for toilet purposes. Also, there was plenty of olfactory evidence that bodies still rested under the ruins of many houses. The people seemed dazed and unable to appreciate what had happened. Many groups seemed filled with a picnic spirit, going from house to house and laughing at the plight of their neighbors who had been fortunate enough to survive.

Then I returned to the aviation field. I found a truck just being loaded with our personal blankets, mosquito nets, lunch, drinking water, canteens, and Doctor Lévêque's suit case. I objected to this but was assured that the truck would wait for us at the fort. I brought the Haitian doctors with me and also the rest of our gear. When we reached the fort I looked for the truck with our personal things but did not find it. An officer standing near said: "Oh yes, that was Red Cross stuff; I sent it out to be distributed to the hos-

pitals." We never found any trace of our things but we soon learned to protect ourselves against those big-hearted people who were always ready to appropriate our things and give them away to others.

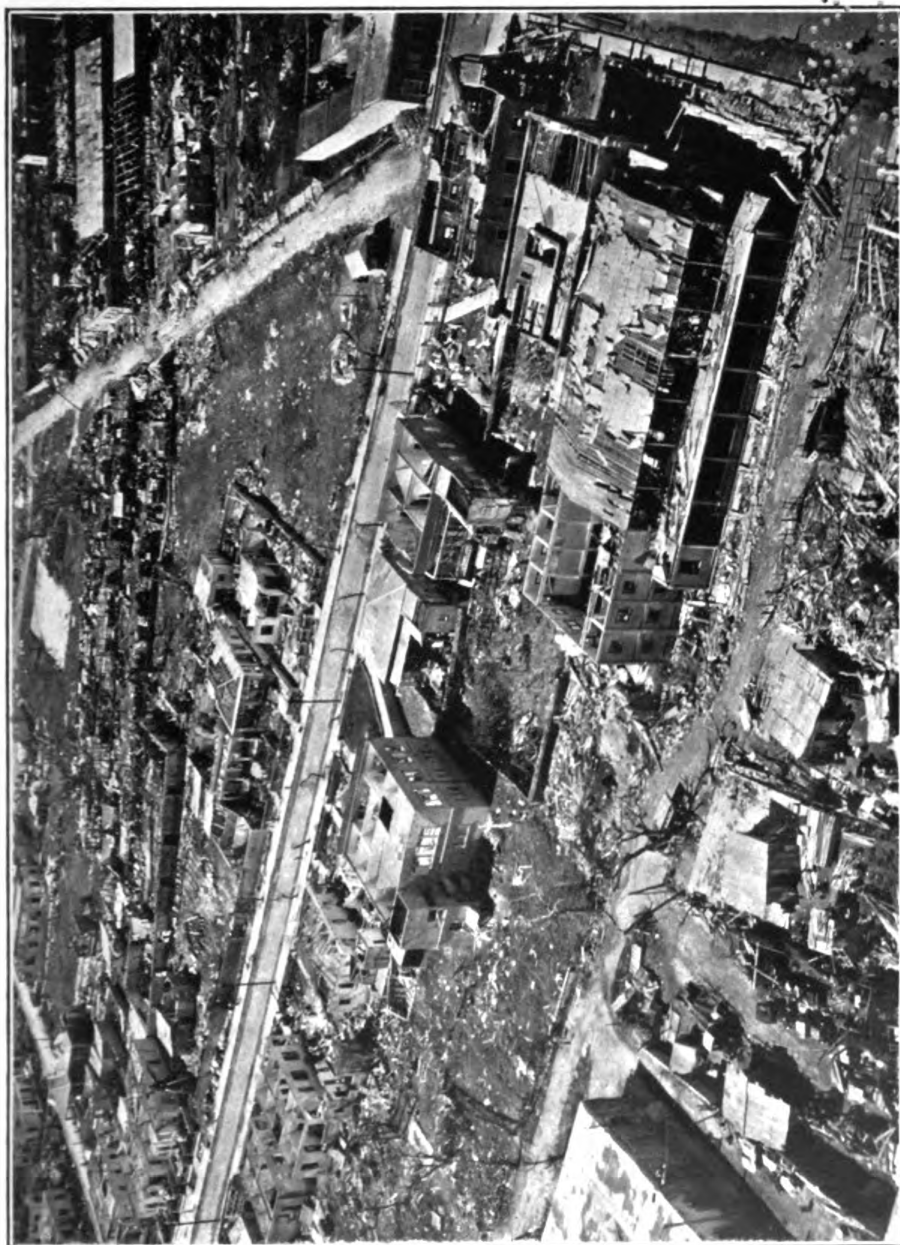
We started on a round of the hospitals, beginning with the Padre Billini. This is a large, airy, well-built hospital with a normal capacity of 120 beds. We found 750 patients and they had had over 800 two days before. Some were on beds, usually two in a bed; others were on bed springs without bedding, others on the floor; some with clothes, some naked. This was the best-equipped and best-managed hospital. Doctor Mejia, the director, knew all about all his patients in spite of the congestion. He knew what operations he had done and how many, and he knew exactly what supplies he needed. There was lack of personnel to organize the proper care of the patients, bathing, feeding, and removal of excreta. In spite of this, there was order and things were being improved every hour. I left Dr. René Nicolas here to help and they were glad to have his aid.

Union Nacional, formerly club rooms, was an emergency hospital, poorly equipped. It had 32 bed patients and about 300 who came daily for dressings. Doctors Marchini and Ginevra (from Puerto-Platta) had worked about 72 hours without rest. I left Doctor Pierre-Louis here to help.

At the National Military Hospital things were very bad. The roof and the second floor had blown away and the place was completely wrecked. The patients who survived were removed to a building near-by and placed in dark, crowded rooms, some with beds and some without. There were about 150 patients, well cared for, considering the conditions under which the doctors worked. I left Doctor Lévêque here. Some patients were still kept in the parts of the military hospital which remained and efforts were being made to clean up the place.

We went next to Doctor DeLara's private hospital, the normal capacity of which is 30 patients. The patients who came to be treated refused to leave; they brought their possessions and moved right in. I counted 13 lying on the floor of his small reception room, eight in his private office, with two babies asleep on his desk. Every room was proportionately crowded and there were 138 patients in the place. Here again was noticeable the lack of anyone to clean the patients or remove their excretions. The demand for labor of any kind was too great to allow any but the most necessary things to be done. On the operating table was a dead body. When I came the next day there was another with it. What trucks survived were too busy to tend to all calls of that kind.

The San Rafael Hospital was formerly a store with apartments above, a modern concrete building, which was uninjured except for the glass windows and the doors. Doctor Calderon was in charge



OLDER RESIDENTIAL SECTION. TAKEN TWO WEEKS AFTER HURRICANE

1853

and had 220 patients. They received good medical care but there was shortage of beds, bedding, clothes, and surgical dressings. Some of the patients had some one to bring them food; the others were less fortunate.

The Evangelical Mission Hospital had been destroyed, so they moved their entire staff and what equipment they could salvage to an adjacent apartment house which was in fairly good repair. They had 82 patients, well cared for and fed. The staff was competent and the spirit excellent.

These were the largest and best-equipped hospitals. There were several other collections of people gathered under some sort of shelter, many of them entirely without proper medical care, food, clothing, or attention. Nearly everybody on the street bore evidences of injury. We realized the necessity of organization for supplying food, clothing, and surgical supplies.

In all the hospitals we found the same needs—food, bedding, clothing, gauze, adhesive, cotton, bandages, tetanus antitoxin, iodine, sterilizing facilities, water, electricity. At every hospital the doctors demanded antigangrene serum. This was new to me, so I passed the demand on to those in Port au Prince. I never found out exactly what was wanted. Although several serums were later sent down in large quantities from the United States, none of them seemed to satisfy. I had seen Doctor Bull's work at the Rockefeller Institute in 1917 with a serum to combat the Welch bacillus, but we were not able to find this in commercial manufacture. I did not see a case of gas gangrene though conditions were ideal for it. Several of the doctors said there were many cases in their wards but they all proved to be simple necrosis, either infectious or traumatic.

Nearly every case showed large, necrotic wounds made by flying sheets of galvanized iron, concrete blocks, or similar missiles; all were grossly infected. Many crushes and bad compound fractures were due to falling walls. Nobody had time to bother about simple fractures. Most of the doctors had been working for 72 to 90 hours, with little or no rest, among the most distressing scenes, with meager equipment and few supplies. They felt the general disorganization but had no time to correct it.

Porto Rico and Cuba each sent complete units and set up their own hospitals. The Cubans came by air and the Porto Ricans by the U. S. S. *Grebe*. They were getting their material ashore in small boats. Since overcrowding of patients in hospitals was the greatest problem, their coming was most opportune.

I visited the Plaza Colombien where they were burning bodies. Over 800 had been burned. They were also being burned in two other places.

There was no disorder. A successful, bloodless revolution had been staged a short time before and the Army was still in control. Martial law was at once declared and everything was orderly.

Mr. Lassiter and Doctor Bourand arrived late in the afternoon, much to my surprise. It was almost a superhuman thing. They left the cars and chauffeurs at Azua, swam and waded the rivers with the medical supplies on their heads, commandeered horses, walked many miles, but they brought the supplies through dry and intact, taking about 48 hours to do the 230 miles. Doctor Bourand had already established himself in a house full of injured people and was hard at work when I found him.

We slept this night in one of the offices of the American Legation, after appropriating cots and blankets from the Porto Rico mission. The roof was half gone so we had to move our cots with every shower. We had some sandwiches and chocolate bars, so we felt very well off.

September 7.—At 5 o'clock in the morning I went down to the wharf to see what supplies were coming ashore. The man in charge was Maj. Cary Crockett, United States Army, a member of Governor Roosevelt's personal staff and one of the Porto Rico mission. They brought tentage, equipment, and staff for a large hospital. The site that I had chosen for our Navy field hospital, near the presidential mansion, we yielded to the Porto Rico unit for their hospital since they had their staff and supplies already here. Our hospital was still in Port au Prince and it would be futile to bring it here and set it up without complete Navy personnel to run it. It would no sooner be erected than a thousand homeless people would move in and we could find no one here so brutal as to put them out.

We visited all hospitals, distributing supplies and ascertaining their needs.

At 3 o'clock in the afternoon the President called a meeting of all the Dominican doctors. After a great deal of discussion some one suggested that, as they were unable to agree on any plan of organization, I be asked to take charge. After several speeches for and against, this was done. I outlined my plan and appointed a committee of five local doctors to work with me in its execution. They were Drs. José D. Mejía, Ramón de Lara, Julio A. Piñeyro, Heriberto Pieter, and Wenceslao Medrano. They were all active, intelligent men of good standing in the community. They proved to be excellent men to work with and there was never any friction in the working of the committee. The President then issued a decree confirming my selection and giving me practically unlimited authority. Dr. A. Fernós Isern, director of the Porto Rico mission, was asked to sit in with us as a member of the committee since the plan involved utilization of the Roosevelt Hospital and other activities of his unit.

The plan, in short, was this: As soon as the Roosevelt Hospital was finished, to move 200 patients from the Padre Billini Hospital to it; clean the Padre Billini Hospital thoroughly and move into it all cases requiring major surgery, making this the principal surgical hospital. Then evacuate and clean the National Military Hospital and move into it all cases with large infected wounds and all cases of tetanus that might develop. Then evacuate and clean the San Rafael Hospital and make it the principal hospital for fractures. Then evacuate and close, as rapidly as possible, all the poorly equipped nondescript hospitals. Hospitals like the Evangelical Mission and the one organized by the Cuban doctors, which were complete units and well administered, we were not to molest, except to provide whatever supplies they might request. This involved a survey of all patients in all hospitals and their division into four groups; first, those requiring major surgery; second, those with large, necrotic wounds; third, those in which fractures were the principal consideration; fourth, those with less serious injuries. Doctor Fernós offered to have this survey made by members of the Porto Rico unit and they worked all night in order to have it ready for us the next morning.

I stated to the committee that it was my purpose to organize the work and turn over each division to Dominicans as rapidly as possible. That if I could not complete the work and turn it over to local men within 10 days, I should consider that I had failed in my mission. Time proved that less than 10 days were necessary. The committee approved everything that I suggested and they all seemed greatly relieved that the burden of organization was lifted from their shoulders.

This day, Charles H. Redfield, pharmacist's mate, first class, United States Navy, arrived by plane from the brigade hospital at Port au Prince with a considerable quantity of surgical supplies and tentage. Mr. Lassiter had an old kitchen back of the American Legation cleaned out and we moved in, using it as living quarters and store-room for our supplies. An old Army man, named Freeman, made us a stew that night and it seemed wonderful after a diet of chocolate bars. This place had another advantage in that it was near to a toilet, one of those minor blessings that one does not appreciate until it is lost. There were very few toilets left in working order in the city and most of those were in such condition that rubber boots were needed to approach them.

September 8.—This morning Redfield had hot coffee ready for us at 5 o'clock, so we started the day right. Major Crockett came in for coffee with us.

Great progress was being made daily in cleaning the streets of the city so that traffic could move. Gangs of prisoners worked day and

night to remove the débris. The work on the aqueduct went forward rapidly and at 2 o'clock in the afternoon the water was turned on. The water was heavily contaminated and notices were posted all over the city, warning the people that it was not fit to drink unboiled. The electric light company had gangs hard at work setting up poles and wires and this night there were lights in a few streets.

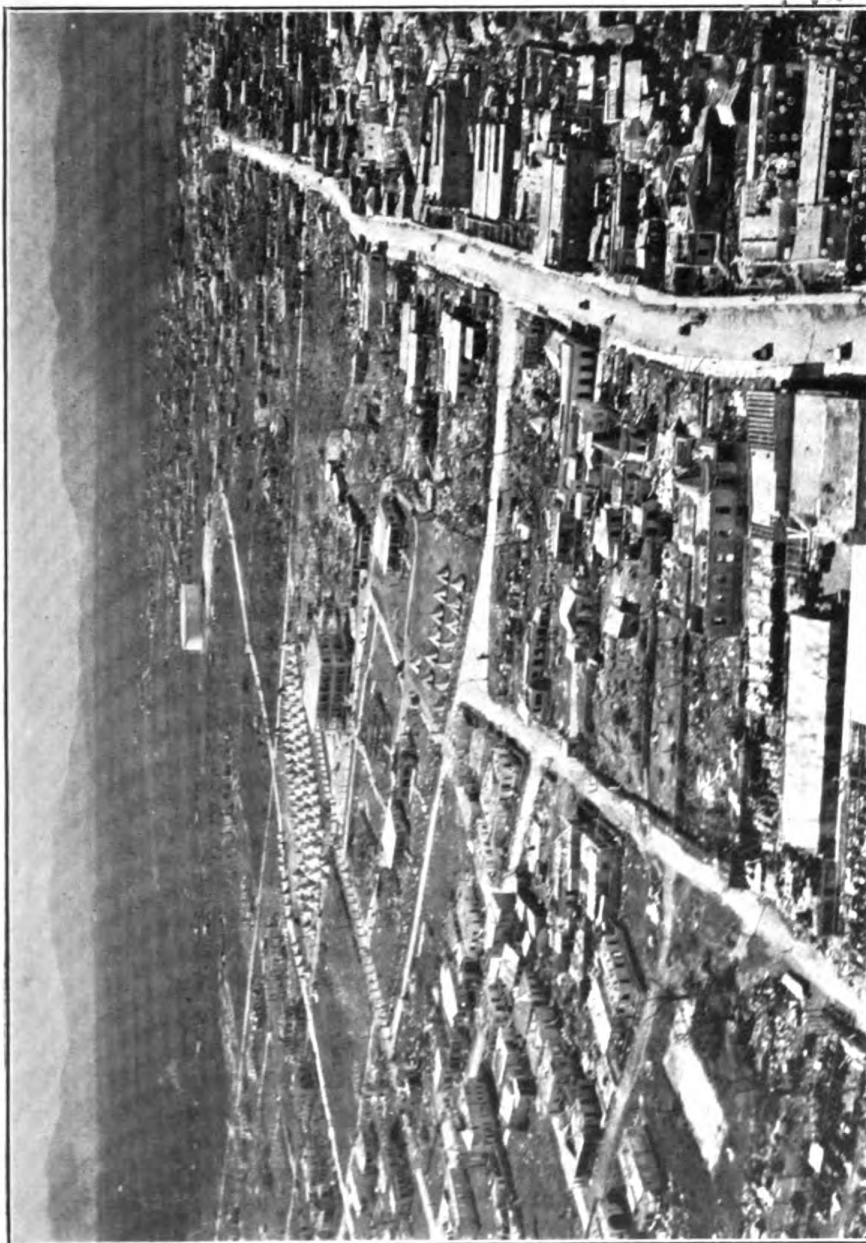
We made the rounds of the hospitals, distributing supplies and preparing for the opening of Roosevelt Hospital the next morning. The survey of the hospitals showed 1,229 patients in the five largest. It became evident that the supply of food to the hospitals and transportation were to be our greatest problems. Distribution of food to the people in the city was unsatisfactory and there were some disturbances at the distributing stations. I mentioned to President Trujillo the importance of appointing some strong man as controller of foods. He asked me to send a wire to Colonel Cutts, the senior officer present at Port au Prince, asking for the detail of a marine officer with experience in Santo Domingo to act as food controller. I did so.

Redfield was sent out to the aviation field with orders to set up two hospital tents as a receiving station for our supplies which arrived by plane. Our supplies disappeared so rapidly that it was necessary to keep a guard over them all the time. A great part of the supplies sent to us from Port au Prince never reached us.

Dr. J. B. Ruiz was asked to take over the job of securing and distributing food to hospitals. It was arranged that each hospital should send to his office, by 11 o'clock each morning, a list of the articles of food and the quantities they would require for delivery the following morning. Doctor Ruiz was to total the quantities for all hospitals and submit an order for signature by the President, authorizing the issue of the required quantities. Colonel Fiallo was placed in charge of all transportation and ordered to supply Doctor Ruiz with the necessary camions to deliver the foods to the hospitals.

Transportation was never sufficient. Thousands of automobiles and trucks were destroyed by the storm. Those that were left worked day and night, clearing the streets, removing refuse, bringing food to the fort, and for many other purposes. The hospital had constant need for trucks to carry food and surgical supplies, remove refuse and dead bodies and to transport patients. I always felt that Colonel Fiallo was most generous in giving priority to the hospitals when trucks were needed.

Commander J. B. Pollard, Marine Corps, United States Navy, came over by plane from Port au Prince, looked the situation over, and made several valuable suggestions before returning. Commander J. N. Laycock (C. E. C.), United States Navy, also appeared. He had come through with a gang of men from Haiti, restoring the



PRESIDENTIAL MANSION IN UPPER CENTER; ROOSEVELT HOSPITAL TO LEFT. TAKEN TWO WEEKS
AFTER HURRICANE



telephone connection between the two countries. The President gave us a house, across from Fort Ozama, to serve as our home and as storehouse for our supplies. The latter would be soon arriving in such great quantities as to require plenty of space for storing and issuing.

Mr. Ernest J. Swift, disaster expert of the American Red Cross, arrived to-day and his advice was a great help to all of us. We arranged a cable message to the American Red Cross in Washington, detailing our needs. He told me that a destroyer was waiting at New York to be loaded with whatever we needed and would sail the following morning. Late the night before, the American minister and I had prepared a message to Washington stating that the needs were too great to be supplied by donations from the neighboring countries, Haiti, Cuba, and Porto Rico, and that aid on a large scale was needed. Mr. Swift had received that message in Miami by telephone from Washington at 3 o'clock in the morning, and by 6 o'clock that evening he was in Santo Domingo with all arrangements made for immediate shipment of medical supplies from the Medical Department of the United States Navy, as soon as our order was received in Washington.

On September 7, after consultation with Captain Stuart, Colonel Cutts had wired Marine Corps headquarters asking for four transport planes to be sent to Port au Prince loaded with gauze, cotton, bandages, morphine tablets, tetanus antitoxin, ether, and chloroform. On the 8th the Bureau of Aeronautics of the Navy Department issued orders for two Navy JR planes to proceed to Hampton Roads, one loaded with biologicals from the naval hospital, Philadelphia, Pa., the second bringing 100 hypodermic syringes from Walter Reed Hospital. At Hampton Roads they were to load to capacity with medical stores from the naval hospital, Norfolk, Va., and proceed to Port au Prince. They were joined by a Marine Corps plane similarly loaded. The U. S. S. *Gilmer* was loaded to capacity with cotton, gauze, bandages, etc., from the United States naval medical supply depot, Brooklyn, N. Y., and proceeded to Port au Prince where she was unloaded and the supplies were sent on to Santo Domingo by plane. The only sure method of supply to Santo Domingo was by the air. Within a few days we received 37,800 pounds of supplies from the Port au Prince base by this route.

This prompt and complete coordination of the Navy, the Marine Corps, and the American Red Cross gave a very fine example of efficient organization. Our service of supply was most satisfactory.

September 9.—To-day the work was started of transferring patients to the Roosevelt Hospital, the tent hospital brought by the Porto Rico unit. Before night 239 patients were moved in. The Red Cross donated \$60 for cleaning the Padre Billini Hospital. The transportation problem was solved by appeal to the President,

who gave a direct order that we were to have four large trucks for the purpose. The work of transporting the patients was supervised by men from the Porto Rico unit. Conditions in the hospitals began at once to improve as soon as the congestion was relieved.

Doctor Ruiz began his work as director of foods for hospitals and it was hoped to have the plan working smoothly within two days. Doctor Medrano was assigned to look into the treatment of patients not in hospitals, who came daily for dressings. He was to see that the places were properly manned and equipped and received supplies regularly. This big assignment was attacked with great vigor by Doctor Medrano and great improvement in the work resulted.

Maj. W. B. Sullivan, United States Marine Corps, arrived to-day and helped greatly to make things run more smoothly. The Dutch cruiser *Arend* arrived and the medical officer, Doctor Mellema, gave us quite a lot of supplies which we needed. A number of sailors from this cruiser were sent ashore to help in clearing the wreckage. The British cruiser *Danae* also arrived and offered help. Four operating units arrived from Porto Rico, each complete with doctors, nurses, and supplies. We sent one to the Padre Billini Hospital, one to San Rafael, and the other two to the Roosevelt Hospital. We now had plenty of doctors and nurses, so I sent a message canceling the request for 10 nurses who were preparing to come from Port au Prince.

The steamer *Genevieve Lykes* arrived from Port au Prince, bringing a cargo of food donated by the Haitian Government. Ruben S. Mixon, chief pharmacist's mate, United States Navy, and Jack Reeves, pharmacist's mate, second class, United States Navy, also arrived and were put to work storing and issuing supplies. John Davis, lieutenant, United States Navy, retired, was also aboard the *Lykes*. I immediately issued orders making him captain of the Port of Santo Domingo. This was an important billet as food ships were arriving and the cargoes were coming ashore very slowly. Lieutenant Davis started in by raising two schooners which were sunk alongside the wharf, making it possible for ships to come alongside. Then he organized the work so well that he later unloaded three large ships in one day.

The Cuban doctors established a 60-bed hospital, well equipped and well managed. They were also dressing about 700 out-patients daily. They were doing an excellent work.

September 10.—This day we moved into our new residence. It had considerable roof but no doors, windows, or furniture. We managed to get a desk, a typewriter, and an oil stove. Mr. Lassiter hired a cook and, from this time on, we had regular meals. The pressure of work was also reduced enough so that we could get plenty of sleep at night.

Doctor Bourand, one of our Haitian doctors, was sent back because of an infected finger which made it dangerous for him to continue. Every one spoke in the highest terms of his work.

British sailors were landed from the *Danae* to-day, by request of the President. They were patrolling the streets, acting as traffic police and guarding food store houses. The Dutch sailors were also ashore, helping to clear the streets.

Three of the smaller hospitals were closed. Before night the Roosevelt Hospital had taken in 400 patients. This relieved the overcrowding of all the hospitals so that conditions improved rapidly. The food came regularly and there were sufficient supplies, so everybody was satisfied. We had to send an urgent message for tetanus antitoxin. Conditions were such that we expected a number of cases of tetanus to develop.

A message came in that a large number of injured had been unable to get into the city. They had gone to San Pedro Macoris, and the hospital there was in great need of food and surgical supplies. I flew over in a Marine Corps amphibian, with a load of supplies, and landed in the bay. I found one of those delightful surprises that one occasionally encounters in a small town—a well-equipped and well-managed hospital with a very able man at the head of it. He was Doctor Georg, a German, idolized by the whole town. He had just finished an appendectomy and a Billroth II gastrectomy when I arrived. He showed me many clever, simple devices for treatment of fractures. After having lunch with Mr. Tatem, the American consul, I returned to Santo Domingo. The rest of the day was spent in smoothing out the difficulties of distribution of food and supplies.

Removal of garbage, used surgical dressings, dead bodies, and other objects from the hospitals was a serious problem. The ordinary service of waste removal was entirely paralyzed and with the great number of patients the waste was greatly increased. At last we were able to get a truck with a sanitary inspector to make the rounds of the hospitals, visiting each one twice daily to remove refuse.

September 11.—On this day the electric current was restored to the Padre Billini Hospital. Ice was secured for the hospitals. Supplies from the United States began to arrive in great quantities via Port au Prince by plane. We secured a small Ford truck to deliver supplies to the hospitals. With Lassiter, Mixon, and Reeves to supervise the service of supplies it moved smoothly. The food distribution worked better. Another small hospital was closed.

The volunteer workers, who had flocked to the hospitals with a fine desire to aid, after the disaster, were beginning to tire of the

work and to consider where food for their families was to come from if they continued to work for nothing. Mr. Swift helped us to solve this problem by allotting Red Cross funds for payment of workers in hospitals. The food for the families of workers was arranged by issuing food cards which entitled them to be supplied daily from the Red Cross stations. The American Red Cross at this time was feeding 23,000 daily.

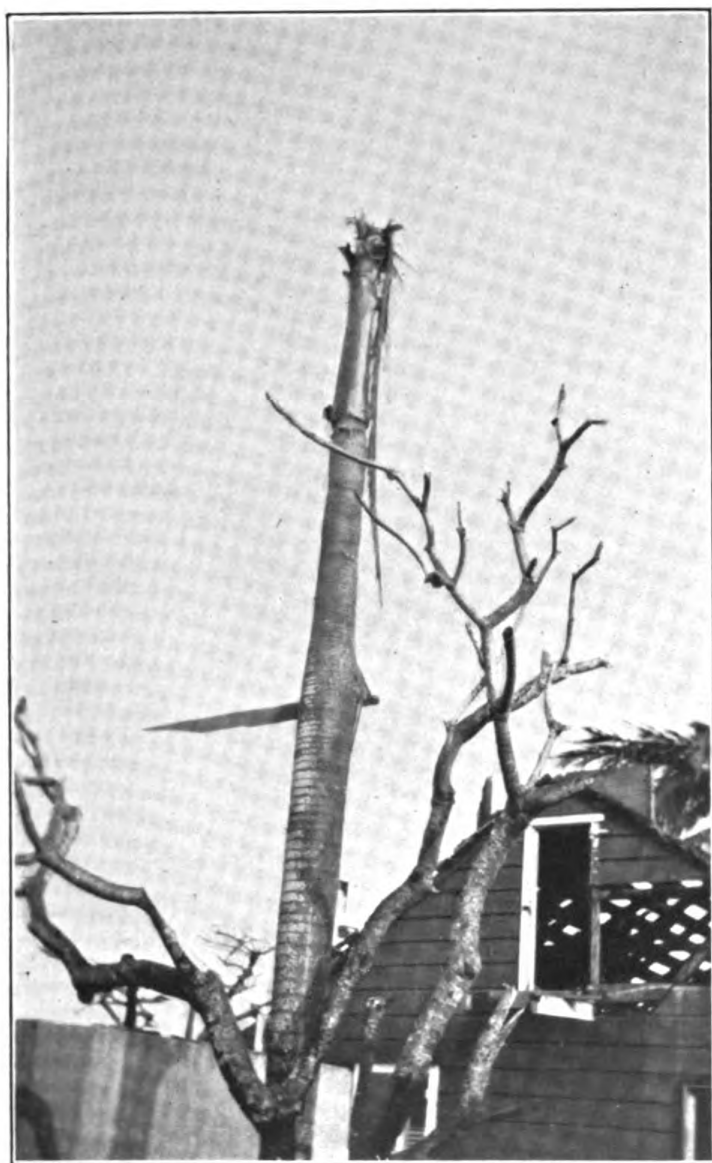
The two cars with chauffeurs that Mr. Lassiter and Doctor Bourand had left at Azua on the 4th arrived to-day. We were glad to have the cars, but the chauffeurs were a liability. They looked with scorn on our rude habitation, said they were much too proud to live like that, and demanded hotel accommodations. We shipped them back to Port au Prince the next day.

It was reported that 12 cases of tetanus had developed so far. This was much less than we had anticipated. Dr. Heriberto Pieters was assigned the task of collecting all cases of tetanus in the military hospital and caring for them there. Word had been passed some days before to all hospitals, reminding them of the importance of the second prophylactic dose of tetanus antitoxin. Up to this day there had not been enough of the antitoxin to provide for treatment of cases that developed, but great quantities had just arrived by plane.

Many large wounds had been sewed up tight at first without removing the stones, splinters, and other foreign matter that they contained. They were coming into the dressing stations and hospitals in large numbers with big, sloughing, purulent wounds which furnished the ideal conditions for tetanus and gas gangrene. I was surprised to see so little tetanus and no cases of gas gangrene. The doctors say it is the custom of the people to demand that wounds be sewed up at once and, in the country, they use the favorite dressing of all primitive peoples, warm bull manure. One must assume that these people have as high resistance to the intestinal bacteria of domestic animals as they do to those of human beings.

A strange anomaly developed when clearance papers were requested for a cargo of corn, beans, and plantains to be shipped to Porto Rico at the same time that a similar cargo was being discharged at the same dock, donated by the people of Porto Rico to the starving Dominicans. It appears that the Dominican Republic is a great food-exporting country and Porto Rico is dependent upon it for food. There will be little need for donations of food as soon as normal transportation is restored. The storm did little damage outside the city.

September 12.—To-day Doctors Lévêque, Pierre-Louis, and Nicolas returned to Port au Prince. They did excellent work here, and I never heard any complaint from them about the discomforts and



TWO BY SIX INCH BOARD BLOWN THROUGH TRUNK
OF PALM TREE

hardships. All the doctors with whom they worked spoke with enthusiasm about their work. All the Haitian doctors have been a credit to their country.

All our troubles now were small ones. Where will the hospitals get salt for the food and charcoal to cook it? Everyone was cheerful; there was plenty of food, plenty of supplies. So we realized that outside help was no longer needed and began to plan our withdrawal. We heard that in response to the President's appeal, Maj. T. E. Watson, United States Marine Corps, was to be sent down from Quantico to act as food controller. The committee of doctors with whom I worked, asked me to recommend to the President that Major Watson be made also controller of hospitals, since the principal problem of the hospitals was still the food supply. This the President approved.

Doctor Furnós, of the Porto Rico mission, desired also to turn over the Roosevelt Hospital to Dominican control as soon as possible. We drew up a plan to be submitted to the President. This plan provided for a medical officer of the Dominican Army to have administrative control, while the medical work should be done by a civilian physician. The female nurses of the Roosevelt Hospital were to be returned to Porto Rico at the same time as the director, Doctor Furnós. The distribution of surgical supplies was to be continued by Redfield and Reeves, under the nominal control of Major Watson. This plan was acceptable to everybody and was approved by the President. It was estimated that the need for the hospital would last about two months more, after which it might well be used as a camp for the homeless.

There were many details about the transfer of the hospital to be arranged with Governor Roosevelt, so Mr. Swift and I planned to fly over to San Juan the following day. Also, I wanted to stay away for 24 hours to see how well the organization worked during my absence.

September 13.—The President approved our plan of evacuation. He selected Capt. Carlos M. Olivo, who was recommended by the committee, to be in administrative control of the Roosevelt Hospital. Dr. Rafael Roca, a young surgeon of excellent reputation, was chosen to direct the clinical work of the hospital. I prepared orders for each one, outlining the scope of his activities so as to leave the least possible ground for friction, and they started at once to learn their new duties.

The first payment of hospital workers came to-day. A pay roll was to be prepared by each hospital and payment made to each individual through the National City Bank. It caused a great deal of confusion as it was difficult to make them understand the necessity

of securing receipts for the money. Some left without their money, thinking their honesty was impugned when they were asked to sign vouchers. By the following Saturday this should work more smoothly. Food cards were distributed for the families of workers in the hospitals. The Red Cross stationed a truck at the outskirts of town and bought charcoal as it was brought in by peasants. After a load was collected, it was distributed to the hospitals. The food distribution was working better, thanks to the firm backing of the President.

At noon, Mr. Swift, Mr. Harwood Hull, of the Associated Press, and I left in a Marine Corps Ford plane for San Juan, Porto Rico, with Maj. Roy S. Geiger, United States Marine Corps, as pilot. We arrived before 3 p. m., a perfect flight over most beautiful country. Commander Kelly met us and took us for a ride through the city. After dinner with Governor Roosevelt, agreement was reached on all points concerning the turnover of the hospital. The complete hospital with 100 tents, 1,200 cots, bedding, complete equipment, and supplies enough for two months, was to be turned over, on receipt, and no salvage expected. So the Dominicans could use everything freely without fear that they might have to account for it later. I found it to be the experience of the Red Cross and the Army that salvage of such materials is hardly worth what it costs to collect it.

September 14.—We took off from the field at San Juan at 6.15 a. m. and reached Santo Domingo City two hours later. Everything had gone well during my absence and I was convinced that I was no longer needed. Rumors of political activities were heard, which indicated that things were fast returning to normal.

Maj. T. E. Watson, United States Marine Corps, arrived and, as soon as I had been with him and President Trujillo a few minutes, I was convinced that he was as good as the 50 marines that the President had requested and Washington had denied.

The Surgeon General of the Public Health Service cabled an offer of an experienced sanitary engineer, to advise in rebuilding and in organizing the sanitary service of the city. This was a very practical aid and met with most favorable reception.

September 15.—This day was spent in arranging small difficulties and planning means for carrying on the work. The doctors demanded that an outside man continue as head of the committee and asked me to have Major Watson act after I left. This was arranged. In these small countries with no middle class, there is no field for the sons of the élite except the professions. So there are more lawyers and doctors than the community can support. This leads to all sorts of intrigue, professional jealousy, and political activity.

Each man doubted his neighbor and wanted a neutral person at the head of the organization.

This was my last working day. During eight days I had seen wonderful changes. The main streets were cleared and traffic was moving freely; the water supply was reestablished; the electric current was supplied to hospitals and rapidly being extended to other buildings. There was plenty of food for everybody; rebuilding was proceeding all over the city; telephones were being installed in public buildings; refuse was being collected regularly and the streets were reasonably clean. The number of sick in hospitals was reduced to 1,200 and about 3,000 were receiving daily dressings. The hospitals were operating well, with plenty of food and plenty of medical supplies. Everybody seemed contented and well fed. Probably half of those in the hospitals could leave as soon as there was a shelter for them elsewhere, but nobody wanted to force them out with no place to go.

The main things still to be organized were sanitation of the city, care of the hundreds of orphans, and rebuilding of homes.

September 16.—The American Red Cross Relief Committee was organized to provide for the continuance of the work. The Red Cross had already spent \$58,000 and left behind about \$100,000 more to be spent. President Trujillo was made honorary president, Major Watson was chairman. Mr. Curtis, the American minister, and other prominent men were members. Major Watson detailed his plans for providing shelter for the hundreds of homeless who were living in the churches and other public buildings, also for the unknown number of women and children without men to provide homes for them.

A lunch given by Mr. Swift marked the end of a very pleasant association and at 2 o'clock Major Sullivan, Mr. Swift, and I took off in Major Geiger's Ford plane for Port au Prince.

After my return to Port au Prince, I was shown a press dispatch to the effect that I had done 65 amputations in a single day at Santo Domingo. It is a shame to spoil such a good story, but the truth is that I did not do one operation there. On the other hand, I discouraged surgery except in the most urgent cases, because of the unfavorable conditions. My entire time was spent in organizing hospitals and staffs, securing food for hospitals, getting medical supplies and distributing them, fighting for transportation to move patients and supplies, getting waste and dead bodies removed and destroyed, organizing dressing stations, closing the worst hospitals and cleaning the others, getting beds, bedding, and clothing for patients.

It will be noticed that mention has been made many times of the Porto Rico mission. They had their hurricane two years ago and

the organization which worked so efficiently then was perpetuated. It was composed of representatives of the Red Cross, National Guard, and the Public Health Service. When the Santo Domingo disaster occurred the unit was quickly mobilized and sent over by ship. It was the largest, best organized, and most effective relief unit. Its members worked in many fields with admirable results.

The sanitation of the city was placed in their hands. They supervised the cleaning of the streets, garbage removal, and the protection of the water supply. They provided sanitary facilities for the overcrowded public buildings in which the homeless sought shelter. The classification of the wounded and the transfer of hundreds of them from one hospital to another was managed by men from this unit. They opened immunization stations and, up to the time I left, had given over 12,000 antityphoid inoculations. The serious danger of a great typhoid epidemic was averted by their work.

They erected a 400-bed tent hospital and maintained it with their own staff. This was the greatest factor in relieving the congestion which had made careful work impossible, even in the best hospitals. As soon as this overcrowding was relieved, conditions improved rapidly in all the hospitals.

No one can estimate how many lives were saved and how much suffering was averted by the work of Doctor Fernos, Major Crockett, and their associates.

The three men of the Hospital Corps of the United States Navy were a source of constant joy. I have always maintained that the men of this corps are the best all-around men that the world produces. Any one of them who has been in the corps a few years is a good carpenter, cook, mason, mechanic, policeman, obstetrician, accountant, nurse, or whatever you need. Mixon, Redfield, and Reeves were a fine trio to have along. Not only did they do their own work and a lot of things that I never thought of telling them to do, but they also found time to help feed and clothe a lot of people who needed it, protect our property, and also find out everything that was going on in town. Redfield, out at the aviation field, dressed all the wounds of all the people for miles around and gave nearly 500 antityphoid injections, in addition to his regular work.

Air transport played a most important part in the relief work. The harbor was blocked, the railroad bridges washed away, and the roads impassible. For several days the only means of access to the city was by the air. Without the air route the city would have been, for a time, cut off from outside aid. All the air traffic passed through the field of the Pan American Airways. Mr. David A. Curtis, the field manager, responded to the unusual demands in a most gratifying manner. We established a receiving and store room at the field, with a guard, and received many tons of medical supplies by airplane.

Another valuable friend was William D. Pawley, president of the Cuban National Airway Curtiss Service. When he heard of the Santo Domingo disaster he took two of his large Ford planes off of their regular run in Cuba, abandoned his business temporarily, came to Santo Domingo, and for several days flew to Port au Prince, San Juan, or wherever supplies were to be brought from. He was a great help in the days when help was needed quickly or it would be too late. I hope he will be reimbursed in full for what his work cost him.

The magnitude of the operations of the American Red Cross and the thoroughness of their preparations for disasters excited my greatest admiration. It was my first opportunity to see the workings of this great organization in action. The calm and efficient manner in which their representative, Mr. E. J. Swift, suggested a simple remedy for each of our most difficult problems was a constant delight to me.

Some time I hope that some one who is qualified to do it will write of what the Dominican doctors did in Santo Domingo. I lack the command of fine language which the subject deserves. Like other people, they had their homes destroyed, members of their families injured, and suffered great financial losses. In addition, they worked for days without rest, with inadequate supplies and under most distressing circumstances to take care of the thousands of injured.

President Trujillo proved to be the finest possible type of man for such an emergency. He was quick to see and understand a problem, accurate in his solution and firm in his action. Every demand that we made upon him was followed by prompt and direct action. Food supply, medical stores, and transportation would have been impossible to secure without his active and complete cooperation. Recovery of the country should be rapid with such a man at its head.

THE RÖNTGEN DEMONSTRATION OF CALCIFIED *FILARIA BANCROFTI* IN HUMAN TISSUE¹

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INTRODUCTION

In many tropical countries where the nematode worm, *Filaria bancrofti*, is indigenous among the native population, the term "filariasis" is used to include a variety of clinical conditions which are

¹ Delivered by Dr. F. W. O'Connor at Naval Medical School, June, 1930. Reprinted, by permission, from May, 1930, number of American Journal of Röntgenology and Radium Therapy.

believed by many workers to be attributable to the presence of the worm. The adult parasite in the human host lives in the lymphatic vessels and glands or in the connective tissues. It manifests its existence either by the presence in the blood stream of embryo worms named *microfilariae*, or by certain clinical phenomena.

The transmission of the infection from man to man is by means of a mosquito, the species varying according to country. When the insect sucks blood from a person harboring *microfilariae* the parasites, on reaching the stomach, shed their enveloping sheath and find their way to the thoracic muscles of the mosquito host. In this situation they lie between the muscle fibers and undergo considerable development. After a period varying according to climate but generally less than 21 days, the parasites migrate to the head and later to the proboscis of the insect. If then the mosquito bites another person the parasites find their way to the skin which they penetrate independently of the wound made by the insect.

The usual manifestations of filariasis are lymphangitis, lymphadenitis, chronically enlarged and varicose glands and lymphatics, hydrocele and chyluria. In filarial countries, lymphadenitis and lymphangitis have been noted in visitors within six months after their arrival and there is good reason for believing that such symptoms are early indications of filarial infection.

The attacks of lymphangitis, though sometimes mild, may be very severe and are then accompanied by chills, fever, and sweating. With the onset of the fever there is frequently vomiting and severe headache and sometimes delirium. Locally, the affected area becomes very painful, tender, red, and swollen. The attacks usually last about a week and in some persons have a tendency to recur with regularity once a month or more frequently. In many cases following a number of attacks, elephantiasis develops and this causes very embarrassing disfigurement. Sooner or later the frequent recurrences of lymphangitis, especially if associated with elephantiasis, may partly or completely incapacitate the patient for work.

If the most severe pain and inflammation during the febrile period occur in the superficial glandular areas and if the glands themselves during the afebrile periods are enlarged and palpable, experience has shown that there are worms in these or the adjacent tissues. In a large proportion of cases, however, symptoms suggest that the worm is in a distal portion of the affected limb or appendage. Recently (2, 3, 4) emphasis has been laid on the presence of a small spot or area in which pain is either the primary symptom at the onset or is most intense during the inflammatory phase of attacks of lymphangitis or elephantoid fever believed to be filarial. Sometimes during the afebrile periods, without visible signs of local

swelling or pain, slight tenderness on pressure may be present in such areas.

The association of these areas with the presence of a living or recently dead filarial worm has recently (5) been confirmed by finding the adult worm or worms in sections of subcutaneous tissue from a number of such "focal spots" in patients suffering from lymphangitis in Porto Rico. It is of interest that after the removal of these focal spots the patients' symptoms have disappeared and there have been no recurrences in a follow-up period of more than a year. It is, however, often difficult to localize the actual site of the worm in such cases as the physician has only the history of the patient and, very rarely, between attacks some local tenderness to assist him. In the majority of cases the history has been the only guide.

Pathological studies by Bancroft (6), Lewis (7), Maitland (8), Young (9), Lothrop and Pratt (10), Manson Bahr (11), and others, have shown that in certain situations, e. g., groin or epitrochlear glands, filarial worms may be present in large numbers, both alive and in various stages of calcification. During recent pathologic studies by one of us (F. W. O'C.) this fact has been noted frequently and in one instance 15 adult worms were found in one group of superficial femoral glands. It was observed in this and many other cases that not only were calcified worms present with living worms but that living or recently dead parasites were frequently found in the *immediate vicinity* of calcified worms. This relationship seemed to indicate that it could not be accidental and to suggest that the finding of calcified worms in less accessible situations might lead to the discovery of living worms. Christopherson (1) has suggested the use of the röntgen ray for the detection of calcified filariae and described a case, complicated, however, by calcification of the anterior tibial blood vessels. He mentioned "cystlike" shadows in the röntgenograms suggestive of filariae. These findings were not confirmed by microscopic studies of the tissues.

STUDIES WITH PATHOLOGICAL MATERIAL

As a preliminary to the present studies with living tissues it was deemed advisable to make Röntgenograms of gross pathological material known to contain adult filariae, of which the following is an example.

CASE S.—A Porto Rican male, aged 40, was murdered and a necropsy performed within a few hours. Hydroceles were found on both sides. The fluid in the right hydrocele contained large numbers of microfilariae. The testicle, hydrocele, and spermatic cord on this side were removed. On examining the cord three hard nodules were felt. These were removed, and on section 7 adult filariae

were found. Three of these were calcified, and immediately adjacent to them were two recently living worms. One of the living worms was a male and the other an immature female.

A Röntgenogram of this specimen was made on a plain film. Scattered throughout its shadow are small, elongated, ovoid areas of calcium density which range in size from about 1 millimeter in width and 2 to 3 millimeters in length to tiny dots. In some places they are single; in others they are arranged in chains of two or more.

CLINICAL STUDIES

In view of these Röntgenographic findings it was decided to study clinical cases by this method.

CASE E. G.—(Unit No. 215002). A white, unmarried seamstress, aged 30, was born in Georgetown, Demerara, where she lived until the age of 18 when she came to New York. Her grandmother and one aunt have filariasis of both legs. One brother has a persistently swollen hand with no history of attacks of lymphangitis.

At the age of 9 the patient had severe pain in the left groin which became swollen and red. The same evening she experienced severe pain in the following regions on the same side: Back of calf 6 inches above ankle; base of the middle toe, where a lump developed on the inside of the instep; sole of foot under the arch; 3 to 4 inches above the knee on the inner side of the thigh at the upper margin of the redness and swelling. In later attacks this was the area of most severe pain.

After the onset of these pains she had a chill followed for three days by high temperature accompanied by headache and nausea but without vomiting. The leg became swollen and red up to the lower part of the thigh. The redness lasted one week. The fever ended with sweating.

The second attack, involving the right leg, came when the patient was 13 years old. It began with "gripping" pain at the back of the calf without pain in the groin. Lumps developed on the outer side of the leg 4 inches above the external malleolus and also 1 inch below the internal malleolus. A chill and fever (103° F.) occurred as in the first attack, and the duration of the fever and the redness were the same.

A year later the patient had an attack in the left leg similar to the first, except that there was no pain or swelling in the groin. Since then she has had an attack every year, usually in July or August, in one leg or the other but never in both legs simultaneously. The legs remained slightly swollen after the first and have become increasingly larger with subsequent attacks. There have been three or four since her arrival in New York. The last, in September, 1923, involved the left leg and was especially severe.

The physical examination disclosed nothing abnormal except considerable enlargement of both legs, more marked on the left. The swelling was of the edematous type. No trophic changes were observed in the skin. There were deep sulci between the bases of toes and the dorsum of the foot on both sides. Tender areas were present on the internal aspect of the tibia, 3 inches above the ankle on the left and a little higher on the right leg in front. On the inner side of the left thigh was a tender spot about $3\frac{1}{2}$ to 4 inches above the condyle of the femur. No redness was noticed and no thickening or swelling was felt in the skin. There was nothing to indicate the possible position of a worm except the patient's statement regarding localized pain and the above-described tender spots.

The blood examination showed, red blood cells, 5,890,000; white blood cells, 10,320; Hgb (Sahli), 98 per cent. Differential count, polymorphonuclears, 62 per cent; lymphocytes, 38 per cent; eosinophiles, 0; large mononuclears, 0. No microfilariae were found in 20 cubic millimeters of blood taken at midnight. The stool examination disclosed no protozoa or helminthic ova. The urine was negative.

Röntgenograms of the left thigh and leg in anteroposterior and lateral positions disclosed two small elongated shadows of calcium density, about 1 by 3 or 4 millimeters, lying in the subcutaneous tissue outside the muscle about 10 centimeters above the knee on the medial aspect. A third shadow of similar size and character lies near the femur at the same level in approximately the region of Hunter's canal, which is a favorite resting place for adult filariae. The position of these shadows in the subcutaneous tissues corresponded with the site of tenderness on the thigh, described above, and they were interpreted as a calcified filaria.

To localize these shadows from excision, four hypodermic needle wires were placed in a square over the region where the shadows were thought to be and fastened in place with collodion. Stereoscopic Röntgenograms were made and the position of the shadows with respect to the wires was determined. The position of the wires was marked on the skin with methylene blue for the guidance of the surgeon.

In addition, a tender area had been located on the anteromedial aspect of each leg as the probable site of a worm, although no significant shadows could be detected on the film.

Operation was performed on February 6, 1930. The following procedure was carried out. A wide elliptical area of skin, subcutaneous tissue and its corresponding deep fascia, measuring about 15 centimeters long and 10 centimeters at its greatest width, was excised. In the area on the inner aspect of the left thigh a silk

suture was taken in the skin as nearly as possible at the site of the calcified worm localized on the Röntgenogram with fine wires as described above. This served as a mark for the subsequent sectioning of the specimen. The skin edges were brought together with fine dermal suture tied over rubber tubes on either side to take up the tension and with a continuous approximating silk suture. Following operation the patient had an uneventful convalescence.

The tissue removed from the left thigh was cut into five large blocks, and Röntgenograms were made immediately after operation before fixation.

As presented for pathologic examination, the specimens consisted of skin and subcutaneous fat which in places was over an inch in thickness. Both dermis and epidermis appeared normal. In the thick subcutaneous fat were markedly thickened blood vessels. No other abnormality was detected.

Block 2, in which the above-described Röntgen shadows were demonstrated, was cut in serial sections and stained with hematoxylin and eosin. In some of the sections two small dark-staining masses could be seen with the naked eye which upon microscopic examination proved to be two calcified adult male filariæ in the fat about 1 centimeter from the surface of the skin. Between the sections of the worm are fibroblasts and large faintly pigmented cells and in places large multinucleated giant cells are present. Immediately surrounding it is a capsule of fibrous tissue about the thickness of the diameter of the worm, arranged in concentric rings. On the inner surface of this capsule there is no evidence of endothelial cells or other structures suggestive of a lymphatic vessel. The worm, therefore, seems to be lying in connective tissue. Among the fibres of the capsule are elongated cells with long nuclei and adjacent to its outer surface are small deposits of lymphoid tissue and isolated groups of small round cells. Around the fibrous capsule is a loose mesh of connective tissue containing numerous engorged blood vessels. Immediately adjacent to the worm the blood vessels are enormously thickened and in some sections almost occluded. Most of the thickening is in the tunica media. Eosinophilic cells are conspicuously absent. In some of the sections practically no calcification is present and the structure of the worm can be made out clearly.

In the same block but in different locations two other very slightly calcified worms, one a male, the other a female, were found. The amount of calcium present was apparently not sufficient to produce a Röntgen shadow.

In block 4 another calcified worm as well as a noncalcified male were discovered. The tissue changes in the vicinity of these worms were identical with those already described. These parasites lie

about 1 centimeter from the surface of the skin embedded in fat and apposed to hypertrophied blood vessels.

Blocks 1, 3, and 5 and the material from both lower legs have not as yet been studied microscopically.

Stimulated by the confirmation of the Röntgen shadows in this case as calcified filariæ, we have made röntgenographic studies of other cases. A 40-year-old negress, born in Antigua, British West Indies, came in with elephantiasis of the right leg and a typical history of filariasis beginning at the age of 26. Röntgenograms of her right leg and thigh disclosed 15 separate shadows or groups of shadows similar to those described above. A man of 30, a native of Dutch Guiana, with a history of filariasis, elephantiasis of the right leg and hydrocele, has two typical chains of shadows in the Röntgenogram of the scrotum. A Chinaman of 45 was admitted because of gonorrheal arthritis of both shoulders and the right foot. Microfilariae were discovered incidentally in a blood smear made in the daytime. He has no history of symptoms suggesting filariasis. A röntgenogram of his scrotum disclosed two small elongated shadows of exactly the same character as those discussed above. Although none of the shadows in these cases have been checked up histologically, there seems to be no reason to think they represent anything other than calcified filariæ.

DISCUSSION

It is obvious that the size of the Röntgen shadow depends upon the extent of the calcium deposit in the worm. Early calcification visible microscopically may not be distinguishable on the film. In Case E. G. the röntgenogram of the specimen after operation disclosed a shadow in block 4, later proved to be a worm, which was not detected on the films made before operation.

The Röntgen shadows in some of these cases are very small and are not easy to detect. A biconvex lens is useful. They are situated among streaky mottled shadows in the subcutaneous fat which, histological examination seems to indicate, are due to markedly hypertrophied blood vessels. The latter cast very ill-defined, fuzzy shadows while those of the calcified worms are a little more dense, clean cut, and sharply defined. To secure the greatest possible detail and to avoid confusion with the tiny spots which are likely to be present with intensifying screens, unless they are brand new, we have used plain films. A fine focus tube and a technique calculated to give soft tissue detail have been employed. Oblique as well as the usual positions in examining the leg are desirable to bring various portions into profile, as the worm shadows lie in the subcutaneous tissue and seem to be easily obliterated by overlying muscle.

An experienced röntgenologist would hardly confuse the shadows of calcified filariæ with those of calcified arteries. Small subcutaneous phleboliths, although not common, are occasionally encountered. Their shadows may be very similar to those under discussion; they are likely to be larger, thicker, smoother, more oval, and to lie closer to the skin.

The relation of the "focal spots" in the extremities to the patient's symptoms has been pointed out in the introduction. The localization of living worms through their juxtaposition with dead calcified worms is important in the surgical attack on the disease as the recurrence of symptoms may be interrupted and the elephantoid leg improved by excision of living worms.

Many workers have shown that numerous adult filariæ may be present within the scrotum and lymph nodes. Our observations show that similar aggregations of worms may be present in small areas in the limbs. It is of interest that in the elephantoid extremities these parasites usually lie between the skin and superficial fascia in an immense fat deposit similar to the masses of fat found in lymph varices in the femoral region and surrounding filarial inguinal and femoral lymph nodes. In this fat marked enlargement and fibrosis of both veins and arteries is present, especially in the vicinity of the worms where these vessels are almost occluded. Hunter's canal, the epididymis and the spermatic cord are also favorite locations for adult filariæ.

These studies seem to indicate that the infection may be quite extensive. Since six worms were found in a small subcutaneous area, it is possible that many others might be revealed by a long and careful search. Fifteen shadows or groups of shadows interpreted as calcified worms were detected in one elephantoid leg. These findings are evidence of hyperfilariation which may have an important bearing on the production of elephantiasis.

SUMMARY

1. The histologically proved juxtaposition of dead, calcified and living, noncalcified adult filariæ in human tissues suggests the possibility of locating the latter by the Röntgen demonstration of the former.

2. Röntgenograms of specimens of skin and of testicle and spermatic cord removed at operation or necropsy from cases of filariasis in Porto Rico and known to contain adult filariæ have shown small shadows of calcium density. Two such shadows from a spermatic cord were proved microscopically to be calcified adult worms.

3. Röntgenograms of the elephantoid leg of a patient with a typical history of filariasis disclosed two small shadows of calcium density in the subcutaneous fat, similar in character to those dem-

onstrated in pathological material, which upon histological examination proved to be two calcified adult filariæ. Near them were two other worms containing so little calcium that they could not be seen on the film.

4. The Röntgen shadows of calcified filariæ vary in size from 1 by 4 or 5 millimeters to small dots, depending upon the extent of the calcium deposit in the worm. They may appear singly or be arranged in chains.

5. Inasmuch as the excision of "focal spots" containing living worms from an elephantoid leg has been followed by improvement in symptoms, the Röntgen demonstration of calcified filariæ may aid in localizing the attack on the disease.

REFERENCES

1. Christopherson, J. B. The radioscopical diagnosis of filariasis. *Brit. M. J.*, 1929, 1, 808.
2. O'Connor, F. W., Filariasis. *Porto Rico Rev. Pub. Health and Trop. Med.*, 1927, 3, 211.
3. O'Connor, F. W., and Burke, G. R. Lymphangitis and filariasis in Porto Rico; report of 57 cases. *Am. J. Trop. Med.*, 1929, 9, 143-177.
4. O'Connor, F. W. An experiment in the treatment of lymphangitis by subcutaneous injections. *Porto Rico J. Pub. Health and Trop. Med.*, 1929, 5, 11.
5. O'Connor, F. W. Unpublished paper.
6. Cobbold, T. S. On filaria bancrofti. *Lancet*, October 6, 1877, 2, 495-496.
7. Lewis, Timothy. Filaria sanguinis hominis (mature form), found in a blood clot in nævoid elephantiasis of the scrotum. *Lancet*, September 29, 1877, 2, 453-455.
8. Maitland, J. Filarial disease. *Brit. M. J.*, 1895, 1, 275.
9. Young, C. W. Filariasis, lymph scrotum and varicose groin glands. *Brit. M. J.*, 1897, 1, 1037-1039.
10. Lothrop, H. A., and Pratt, J. H. A report of two cases of filariasis. *Am. J. M. Sc.*, 1900, 120, 525-553.
11. Bahr, P. H. Filariasis and elephantiasis in Fiji, being a report to the London School of Tropical Medicine, London, 1912, Witherby & Co., 200 p.

LOWERED BASAL METABOLISM; ITS CAUSES AND CLINICAL SIGNIFICANCE

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Metabolism is the regeneration and degeneration of the cells of the body. In these building-up and breaking-down processes which are constantly going on in the body, oxygen is taken up by the tissues, and carbon dioxide is eliminated after the combustion. During this interchange of gases heat is created and bodily warmth maintained. The oxygen consumed and the heat liberated can be meas-

ured, and these results of metabolism have been worked out for various healthy bodies under uniform or basal conditions.

The basal metabolism does not mean the lowest rate of metabolism, which usually occurs during sleep, but the rate under basal conditions. These conditions are a good night's sleep, no food for 14 hours prior to the test in the morning, and complete muscular and mental rest on a comfortable couch for 30 minutes immediately preceding and also at the time of the test.

In practice, basal metabolism is usually determined in the morning, before the subject has breakfasted. A cup of coffee with a small slice of toast taken an hour and a half before the experiment has proved to have only slight measurable effect (2 per cent) on the metabolism obtained in this manner. A meal affecting the basal rate even less may be taken; this consists of one cup caffein-free coffee, 16 milligrams saccharin, 20 grams medium cream, and 25 grams potato chips, having a total caloric value of about 250 calories. Such a breakfast has been shown to have practically no effect on the basal rate 60 minutes after ingestion. The calories developed under these conditions may be expressed in terms of the total daily calories, as calories per kilogram per day, per surface area, etc. Because of the constancy of the law established by Rubner, that the metabolism of all warm-blooded animals varies as the surface area, the calories per square meter of body surface seems to be the most logical manner of recording the data.

Through the work of DuBois, the calories per hour per square meter of body-surface have been shown to be the most convenient basis for comparison. This worker has constructed a very convenient chart for determining the surface area of man.

Basal metabolism varies considerably according to age and sex, as may be seen in the following table (Aub and DuBois):

Calories per square meter of body surface per hour height-weight formula

Age, years	Males	Females	Age, years	Males	Females	Age, years	Males	Females
14 to 16.....	46.0	43.0	20 to 30.....	39.5	37.0	50 to 60.....	37.5	35.0
16 to 18.....	43.0	40.0	30 to 40.....	39.5	36.5	60 to 70.....	36.5	34.0
18 to 20.....	41.0	38.0	40 to 50.....	38.5	36.0	70 to 80.....	35.5	33.0

The difference between the ages and sexes may be explained on the basis of cellular activity and protoplasmic mass. Benedict states that "the basal metabolism is a function of both the total mass of active protoplasmic tissue and of the stimulus to cellular activity existing at the time the measurement of metabolism is made." There is a very considerable variation, both in health and disease, which must be thoroughly appreciated if dietaries are to be wisely con-

trolled. A variety of conditions seems to affect basal metabolism. The energy requirement increases from infancy to 5 years of age, when it is greater than at any other time of life. After 5 years there is a rather sharp decline until adult life, and then a very gradual diminution to old age. Men and women follow the same curve, the latter, however, at a slightly lower level. In some women there is a premenstrual rise in basal metabolism with a rather sharp fall to normal as soon as the period is established. In others menstruation seems to have no effect on the metabolism. After the fifth month of pregnancy there is a gradual rise in the basal rate until parturition, due probably to the increase in the active protoplasmic mass. Continued fasting lowers basal metabolism. Athletes develop more heat than nonathletes. The eating of food increases metabolism. Infections with rise in temperature or rises produced by the introduction of foreign protein increase the metabolic rate. It may be added that temperature and climate also modify basal metabolism.

BASAL METABOLISM TEST

In order to understand any deviation from the average which might be considered a lowered basal metabolism, it is necessary to take into consideration the above mentioned factors and also to understand the method of determining the basal metabolism rate (B. M. R.). There are a number of instruments on the market, more or less all showing uniform results, but varying considerably in complexity of technique. The two most commonly used instruments, the Sanborn "Grafic" and the Jones "Metabolimeter," might well be discussed here.

Sanborn worked on the principle that since heat production is directly dependent upon the amount of oxygen consumed in oxidation or combustion processes, the basal metabolism rate may be computed if the amount of oxygen consumed can be accurately measured.

When using the Sanborn apparatus the test is run from 8 to 12 minutes, and oxygen from a tank is allowed to flow into the spirometer which is suspended and properly counterbalanced. This spirometer is attached to a tube, the end of which is fitted tightly into the patient's mouth. As the patient breathes pure oxygen the spirometer ascends and descends at each respiration. Of course the nose is clamped in such a manner as to prevent nasal breathing. The carbon dioxide exhaled back into the apparatus is absorbed by a chemical known as Sansoline. While the patient is breathing, an inked pen traces a graphic record on a calibrated paper chart which is sealed around a metal cylinder. This cylinder makes one complete revolution every 8 minutes, and as the patient breathes the spirom-

eter bell rises and falls and the pen, following each ascent and descent of the spirometer, traces a series of upstrokes and downstrokes which correspond to the expirations and inspirations. After 8 to 12 minutes the machine is stopped, the cylinder is removed, and the chart slid off, and then cut along any of the vertical lines which represent 1-minute intervals.

A "slope line," extending clear across the sheet, is now drawn on the chart. This line is drawn in such a manner as to represent a fair average of the expiration peaks. A steep slope will immediately indicate that a large amount of oxygen has been consumed, while an almost flat slope will be indicative of a smaller consumption of oxygen. The readings in cubic centimeters of oxygen are now taken at the extreme ends of the slope line, and by simply subtracting the lowest from the highest figure, consumption in cubic centimeters of oxygen during the test will be obtained.

Inasmuch as temperature and barometric conditions have a direct bearing on the oxygen consumption, it may be necessary now to make correction—one for barometer if the pressure is either above or below 760 millimeters, and another for temperature if the thermometer on the "Grafic" shows any other reading than 21° C. These corrections can be readily and simply made by referring to the temperature and barometer tables, which indicate the number of cubic centimeters which should be added or subtracted from the final figure obtained from the slope line. This corrected figure gives the actual consumption of oxygen during the test for a period of one minute.

The next step is to find out the normal oxygen consumption for the patient under consideration. Sanborn has prepared the so-called "normal" tables. These are based upon two factors, height-weight component and sex-age component. The height-weight component table appears on two printed sheets and tells at a glance how much oxygen a normal person would consume, were he or she of the same height and weight as the patient just tested. The "normal" just obtained for the hypothetical normal patient should now be corrected for the sex-age component by using a table prepared for this purpose. When these corrections are properly made the normal consumption of oxygen will be known.

The final step is now the determination of the basal metabolism rate. To obtain this rate reference must be made to another set of tables and figures located on the top or bottom of the chart which corresponds to the normal consumption, and to figures on either side which express the actual consumption of oxygen. If a perpendicular line is drawn through the normal figure and another line horizontally through the actual figure, the rate will automatically be indicated in the right angle formed by the junction of the two lines. This figure

will either be preceded by a plus or minus sign. Plus sign indicates an increase and a minus sign a decrease in the metabolism rate.

Jones worked on the principle that oxygen, like other chemical elements capable of taking part in a chemical reaction, liberates a definite amount of heat when used in the oxidation process going on in the body. This heat value of oxygen is 4.825 calories per liter of the gas, at the respiratory quotient of 0.82. The metabolimeter, therefore, is designed to operate on this principle, and is so constructed as to eliminate the corrections and calculations mentioned for the "Grafic."

The average time required for the test when using the metabolimeter is from 5 to 10 minutes. The gage is constructed to operate like a blood-pressure gage, and is "self correcting," so that the rate percentage is read off directly from the apparatus.

CLINICAL APPLICATION

Information which interests the clinician most vitally is obviously that which concerns the clinical applications of the basal metabolism test in diagnosing and treating conditions commonly encountered in the usual routine of a medical practice. Patients presenting unexplained symptoms of endocrine disturbances are by no means rare, and it is in such cases requiring differential diagnosis that the metabolism test finds frequent use.

In the incipient stage of hyperthyroidism the diagnosis is of greatest importance from the standpoint of successful treatment, since any of the cardinal symptoms of tumor, tremor, rapid heart, exophthalmos, weakness and loss of weight, may either be absent or attributable to some other suspected disease. Therefore, any patient with a resting heart rate above 90 which is not assignable to some definite cause, should have a basal metabolism test, if hyperthyroidism is to be ruled out. Similarly, complaint of persistent feeling of weakness suggests hyperthyroidism, even in the presence of a definite neurosis, and should be differentiated from this common condition.

Also a simple nontoxic goiter may be associated with other symptoms suggesting toxic goiter; and tremor, although common enough in alcoholics, smokers, and neurotics, has often been the first symptom to call attention to the possibility of an overactive thyroid.

The diagnosis of hyperthyroidism is missed so often because no single symptom of the disease is constant, and because each and every symptom may be assignable to some other cause quite as obscure as the hyperthyroidism itself.

The symptoms of hypothyroidism are equally obscure. Often, if we wait for the characteristic symptom of myxedema to appear, we miss the diagnosis. Obesity may or may not be present, and even if present, may be the simple obesity of big eaters or inactivity,

instead of the pathological obesity resulting from the suboxidation associated with hypothyroidism.

In the simple obesity of big eaters and inactivity, the rate of metabolism is not changed from the normal. In the obesity of hypothyroidism and of hypopituitarism the rate of metabolism is from 25 to 35 per cent below normal. In the simple obesity the treatment is caloric control of the diet, and thyroid extract is positively contraindicated. In hypothyroid obesity, thyroid extract is virtually a specific, but must be regulated by the basal metabolism test as the treatment progresses and the rate of metabolism is brought back to normal.

Bronzing of the skin, with asthenia, low blood pressure, the gastric disturbances, speak for Addison's disease, but any of these symptoms may be absent except the pigmentation, and pigmentation is seen in many other conditions. In Addison's disease the rate of metabolism is from 25 to 40 per cent on the minus side of the normal limits.

The textbook picture of *dystrophia adiposa genitalis* of Froehlich's syndrome is most commonly diagnosed as hypopituitarism, in which the basal metabolism is subnormal, whereas the condition is really most commonly due to eunuchoidism, in which the metabolism rate is not subnormal and in which the prognosis and treatment are radically different from that of hypopituitarism.

The basal metabolism test is of most value in diagnosis of the border-line cases of hyperthyroidism, and while one seldom requires the test for recognition of the more advanced cases, it is most often in the advanced cases that the test is required to show how the disease in each individual case responds to some treatment such as X ray, rest in bed, ligation or thyroidectomy, and also to indicate which form of treatment in a given case is the better one to employ at the outset.

Nothing is more striking than the use of the test in determining whether or not the correct dosage of thyroxin or thyroid preparation is being used, in the treatment of myxedema, since such preparations vary in strength from nothing to full potency, and since individuals vary in the amount of the drug they require to bring the metabolism up to the normal basal level.

LITERATURE

Warren tabulated the low basal metabolism values from 5,000 consecutive case tests recorded at the Clifton Springs Sanitarium and Clinic. The cases selected for study were those in which the basal percentage was 20 per cent below the normal. One hundred and ninety tests were done on 156 patients. In the nonsurgical group there were 131 cases listed and in the surgical group 21 cases were

studied. In the medical group there were 108 females and 23 males. The age distribution was: 8 in the second decade, 11 in the third, 18 in the fourth, 44 in the fifth, 34 in the sixth, 13 in the seventh, and 3 in the eighth. Most of the cases showed no marked variation in temperature, pulse, or blood pressure readings from the normal. Approximately as many of the patients were underweight as overweight. The blood counts revealed a mild anemia in about 27 per cent of the cases. Some abnormality of carbohydrate metabolism, perhaps secondary to thyroid disorders, was found in 12 per cent. Low gastric acidity (8 per cent) and various abnormal cardiac conditions (9 per cent) were somewhat higher than among general admission, and may not have been related directly or indirectly to the low basal rate. The incidence of focal infections was high (45 per cent) but perhaps not higher than that usual to patients in the same age group. Fatigue was most frequently listed as the chief complaint suggesting a type of patient upon whom such studies may be of value. Diagnoses of psychoneuroses, psychasthenia, hysteria, etc., were frequent and again suggest a group of patients where such studies may be of use, and where controlled by therapy tending to raise the basal rate may sometimes be advantageous.

Ried and Kenway reviewed some of the pertinent literature on the clinical and electrocardiographic aspects of low basal metabolism and reported a study of the electrocardiographic findings in patients exhibiting a low rate of basal metabolism. Their own study represents a total of 590 cases. They compared the findings shown in electrocardiograms of 260 cases with basal rates of from -10 per cent to -48 per cent with those in electrocardiograms of an equal number of patients whose basal metabolism was normal (between -10 per cent and plus 10 per cent), and 70 patients with a basal metabolism above normal (ranging from plus 10 per cent to plus 96 per cent). The results show a P wave (0.1 mot. or less) in 96 of the 260 cases with low basal metabolism, as compared with 87 of the 260 cases with normal basal metabolism; a low T (0.2 mot. or less) in 37 of the first group and in 46 of the second group; low R (less than 1.0 mot.) in 50 of the first group as compared with 37 of the normal group. From their studies they conclude that no electrocardiographic findings characteristic of low basal metabolism were found. The definitely myxedematous subjects, on the other hand, showed changes described by other investigators.

Womack, Cole, and Heideman made experiments on 19 dogs. Of this number 7 were fed iodine in the form of Lugol's solution, 2 were fed thyroid extract, and 10 were used as controls. The iodine feedings (1 minim per kilogram of body weight, masked in food) were begun several days before the infections were produced, and

continued throughout the experiment. A few infections were produced by ligation of the appendix. The majority were produced by the injection of a toxin consisting of the contents of a strangulated loop of gut. Upon culture the toxin was found to contain hemolytic streptococcus, *B. Welchii*, *B. coli*, and *B. proteus*. The amount used was about eight-tenths of a cubic centimeter per kilogram of body weight. Daily basal metabolism readings were made until the animals died. From these studies it was found that characteristic microscopic and chemical changes were produced in the thyroid glands of dogs by the experimental production of infections and toxemias. These changes were associated with a rise in basal metabolism. The feeding of iodine tended to prevent these changes and to lower the basal metabolism.

Smith and de Conto-e-Silva measured under physiological conditions, the changes in basal metabolic rate of trained dogs after massage of the thyroid glands, and followed this basal metabolic rate over a considerable period of time. This work was undertaken as a corollary to the attempts by Carlson, Hektoen, and Schulhof to see if the temporary change in electrical tension in the thyroid gland induced by massage, as reported by Cannon and his coworkers is in any way related to an increased thyroid hormone output. It was found that in dogs without anesthesia and under as nearly physiological conditions as possible, there was at no time an immediate rise in basal metabolic rate following massage, but on the contrary there was frequently a fall in the rate. This was probably due to the greater relaxation on the part of the dogs, for they seemed to enjoy the massage.

Thompson and Thompson collected 66 cases showing a basal metabolic rate below minus 15 per cent after treatment for toxic goiter. Only 11 of these had signs and symptoms that were characteristic of definite myxedema. In 3 cases the myxedema was temporary and in 8 presumably permanent. It is considered significant that in 1 of the temporary cases the myxedema was shown to be the result of the postoperative administration of iodine. Of the remaining 55 nonmyxedematous patients, in 26 the low metabolism was temporary and in 21 permanent; in 8 its type could not be determined. It is shown that the temporary depressions of the metabolism, unassociated with myxedema, were probably due to two things: 1. A temporary thyroid deficiency, which, because of its short duration, was not detectable clinically. 2. A transient return to the normal metabolic level of the individual. Permanent low metabolism without myxedema following thyrotoxicosis appeared in most instances to represent a return to a normal metabolic level, which was probably low even before the development of the disease. The interpretation

of the degree of basal metabolic elevation in thyrotoxicosis is, therefore, directly affected by the level of the patient's normal metabolism. In most of the patients with myxedema the basal metabolic rate was below minus 25 per cent. In all the patients whose low metabolism could be regarded as normal, the rate was above minus 25 per cent.

Kulingowski reports the case of a female patient of 58 years with signs of thyroid insufficiency; edema, dryness of the skin, lowering of basal metabolism, flattening of the P and T waves of the electrocardiogram, slowing of cardiac contractions on radioscopy, increase in amount of albumin in the serum up to 10.25 per cent; diminution of urine, suppression of sweat, chilling, insensibility with regard to vegetative poisons, slowing of movements, slight hebetude. At the same time the patient presents a series of neurologic symptoms of undoubted organic origin.

After treatment with thyroidin for a week, the signs of thyroid insufficiency disappeared; the neurologic signs subsided in part. The Wassermann was slightly positive, and thyroid treatment was interrupted to institute specific treatment; it was without effect on the nervous system and the hypothyroid symptoms reappeared. Kulingowski believes that these nervous symptoms are dependent upon the hypothyroidism.

Koehler used as a criterion for the activity of the ovarian hormone the determination of the gas exchange. In their castration experiments Loewy and Richter found a fall of oxygen consumption of about 15 per cent following deficiency of sex gland function, which they could again adjust by administration of specific ovarian substance. Since these observations were reported, the determinations of basal metabolism have also been undertaken during the menstrual cycle, in conditions of ovarian insufficiency or following administration of ovarian substance, and there are numerous experimental and clinical investigations on the subject.

The results of these investigations by Heyn, Klawns, and Hornung show that the cyclic processes of ovulation and of menstruation exert no direct influence on the basal metabolism. The above-mentioned authors could also determine a slight fall of basal metabolism in mild forms of ovarian insufficiency as well as at the time of the climacteric and following surgical or X-ray castration only in isolated cases, whereas the greater number were associated with normal or slightly raised gas exchange. Lüthje obtained the same results.

In investigations concerning the influence of administration of ovarian substance on the basal metabolism a not inconsiderable rise of basal metabolism (of 6 to 23 per cent) was obtained by Brugsch and Rothmann, Heyn, and Hannes. Recently, at the suggestion of Prof. H. Zondek, in a great number of patients with visible signs of

disturbed sex gland function the authors attempted to influence the gas exchange with ovarian preparations. For these experiments they used the ovarian hormone prepared by B. Zondek and Aschheim in water-soluble form, the activity of which had been demonstrated on the basis of test methods used.

From tables given in the original article it is to be seen that the authors could not discover any influence of administration of ovarian hormone on gas exchange in any of the cases investigated. The fact that in countless cases of objectively visible disorders of the sex glands function, as for example in obese castrates, the author was not successful in raising the gas exchange by ovarian hormone administration or in obtaining an increase in weight, indicates that the sex glands have only a slight, if any, importance in the occurrence of obesity, and that to the pituitary and thyroid must be ascribed the dominant rôle as regulators of the economy of the organism. It is to be assumed that the adiposity appearing after castration is not directly caused by loss of the sex glands, but arises by way of secondarily induced changes in the pituitary or thyroid.

Langfeldt reports a detailed clinical examination of 40 unquestionable cases of dementia præcox. He used every known diagnostic test of any value. His cases fell into three groups—16 catatonic, 11 hebephrenic, and 13 mixed. In the catatonic group he found the following essential disturbances present in both the acute and the quiescent cases: Slow pulse, low blood pressure, lymphocytosis, glandular swelling, positive pilocarpin test, positive Ascher reflex (vagotonic signs), and reduced basal metabolism.

Bowman studied 24 cases of schizophrenia, both male and female, and found an abnormally low basal metabolism in 50 per cent, with a tendency to low or minus reading in nearly all the rest of the cases.

THYROID GLAND ACTIVITY IN RELATION TO LOWERED METABOLISM

The removal of the thyroid gland alone, leaving the parathyroids intact, gives rise to a condition of malnutrition and finally cachexia. When the operation is performed on young animals, growth ceases. Thyroid function, then, is not essential to the vegetative life of adult animals, but it is essential to normal growth. The growth of bones, ossification and dentition are delayed and mental development arrested by lack of the thyroid secretion; its absence lowers metabolism.

The thyroid has a peculiar affinity for iodine. After the injection of 50 milligrams of potassium iodine into the femoral vein of a dog, the iodine content of the gland may be increased several hundred per cent, and the administration of iodine in any form causes the iodine store to be increased to the maximum. Measured in terms of

iodine, the maximum storage of the human thyroid is approximately 1 milligram per gram of fresh gland. Rapidly stored iodine is at first inactive but the transformation to the active form can be demonstrated after 24 hours by means of the tadpole test (Marine). There is no detectable ratio between the active and inactive iodine in the thyroid, and this possibly indicates that active iodine is slowly elaborated from inactive iodine taken from the blood and is discharged into the circulation or stored in the colloid.

Removal of the thyroid causes a lowering of metabolism as much as 40 per cent. This decrease in heat production begins about the sixth day after removal and reaches its maximum after a variable interval; in small animals, such as the cat, after three weeks. The lower level of metabolism is permanent unless there are accessory thyroid glands which may hypertrophy and meet the demands of the organism.

Administration of thyroid substance, on the other hand, causes a striking increase in heat production, a phenomenon first demonstrated by Magnus-Levy (1895), and this heightened state of metabolism is accompanied by evidences of nervous and vascular disorder such as restlessness and rapid heart action.

Between these two extremes the thyroid displays great variations in the life of the individual. As measured by iodine storage there is an increase during summer and a decrease in winter. But the most remarkable changes in activity of this gland are associated with the sexual life of the female. The swelling of the thyroid at puberty, during pregnancy, and at menopause, are ancient observations. The rise in heat production during pregnancy is probably related intimately to thyroid function, since the rise does not occur if the gland is removed. It has been conjectured, too, that the thyroid is instrumental in the increased heat production accompanying bacterial infections; the gland often swells at such times.

The evident interrelation between the thyroid and the functions of the sex glands has been the subject for many investigations. Embryologically considered, the suprarenals are sex glands, and since intravenous injections of epinephrin cause a distinct rise in metabolism, it is possible that the adrenals are concerned in the total heat production of the body. Aub noted a reduction of about 25 per cent in metabolism after removal of both adrenal glands from cats. This decline in heat production occurred whether the thyroid had been removed or was intact, indicating that this gland is not essential to this reaction. In the rabbit, Marine found that three types of reaction may result following injury of the suprarenal by freezing or by its removal. In 11 per cent of animals there was a fall in metabolism beginning within 48 hours after operation and con-

tinuing until death; in 59 per cent there was an increase, lasting from a few days to several months, followed by a fall to normal or sub-normal; in 29 per cent there was no change in metabolism. In another series of experiments the rise in heat production failed when the thyroid had been removed.

Regarding interrelations between thyroid and other glands of internal secretion the evidence is also unsatisfactory. There is experimental evidence suggesting that growth of the female sex organs is more dependent on thyroid function than is the case in males, since the uterus and ovary degenerate when young animals are deprived of the thyroid.

The administration of pituitary gland to thyroidectomized rats tends to prolong life (Larson), and the conclusion is drawn from these experiments that there is a thyroid-pituitary relationship. An hypertrophy of the pituitary is stated to occur after the thyroid is removed.

A remarkable antagonism of the thyroid to the thymus gland is suggested by the experiments of Gudernatsch, who noted that young tadpoles fed upon thymus gland are stimulated to excessive growth and the metamorphosis is delayed. When thyroid substance is fed, however, metamorphosis is accelerated, growth inhibited, and dwarf frogs are produced. Thyroxin causes the same effect. But the physiological responses of amphibians and mammals to thyroid administration may depend on different chemical grouping within the hormone, since the acetyl derivative of thyroxin is a highly active agent in inducing metamorphosis of tadpoles, but excites no physiological responses in man, while thyroxin accelerates heart action to a notable degree (Swingle). Chemically, the only difference between thyroxin and the acetyl derivative is the substitution of acetyl for the hydrogen of the amino group.

The acceleration of the metamorphosis of the tadpoles by thyroid feeding has been applied as a test for the thyroid hormone. Mice fed on thyroid substance develop an increased resistance to poisoning by acetonitril (Hunt) and are abnormally sensitive to low oxygen pressure (Asher). These phenomena constitute the tests known for the presence of thyroid hormone.

The etiological identity of the several disorders showing a lowered basal metabolism rate and associated with decreased activity of the thyroid gland is regarded as fully established. A peculiar train of symptoms which was observed to follow total thyroidectomy for goiter was described by Reverdin in 1882, and the next year by Kocher, and named by the latter "cachexia strumipriva." The experiments of Victor Horsley on monkeys and other animals led the commission to conclude that (1) myxedema and cachexia strumipriva are identical; (2) sporadic cretinism is myxedema; (3) en-

demic cretinism is also closely allied to myxedema; (4) these conditions are dependent on loss of function, due to removal or disease of the thyroid gland.

The experiments of Schiff demonstrated that the fatal issue following thyroidectomy in dogs could be avoided by transplanting another thyroid into the abdomen. Horsley, in 1890, suggested grafting as a method of treatment for myxedema, and Battencourt and Serrano, acting upon his idea, transplanted thyroid tissue and noted a favorable result in the patient. Later it was found by Murray that the ingested gland met all the metabolic demands.

Differences in the clinical pictures produced by thyroid insufficiency are usually assigned to two factors: (a) The amount of intact and functioning gland and (b) the age of the individual when the thyroid defect occurs. The amount of functioning gland tissue varies and might, of course, determine the severity of the disease and the rapidity of its course in untreated cases. And, since normal growth is in so many respects dependent on normal thyroid function, any imperfection in gland activity which might arise during adolescence would be manifested in a manner quite different from that which characterizes imperfect function in the adult. The growth and ossification of the bony skeleton are in some way influenced by the thyroid so that when the body is deprived of thyroid secretion in early life, growth is retarded and ossification delayed, with dwarfism as a result. There is likewise retardation or even cessation of mental development. Cretins are always defective mentally and many are helpless idiots.

One important difference between athyrosis developing in adult life and the disease in childhood must be noted. Adults may be cured by thyroid treatment, and children may be helped, but cretins seldom, if ever, attain normal mental and physical development. This difference is impossible to explain if, as is commonly assumed, the dried gland, which is used for treatment, supplies all the elements normally furnished by the living gland. Bearing in mind the nice relation which seems to exist between glands of internal secretion, it is highly probable that congenital defect of the thyroid or its early atrophy, leads not only to thyropriva symptoms but to changes in other glands, the manifestations of which we can not yet appreciate. In this relation attention may be directed to the well-known hyperplasia of the hypophysis resulting from thyroid deficiency. The fact has support not only in clinical data but has been tested experimentally. There is now some evidence to indicate that the hypophysis may function in some degree vicariously for the thyroid. Larson also found that the administration of the anterior lobe of the hypophysis has a beneficial action on the main-

tenance and growth of thyroidectomized rats. Further, changes in the parathyroids have been noted in cretins and are found commonly in thyroidectomized animals. Having in mind, then, these subtle relations which at present we do not at all comprehend, the conclusion that all forms of anthyrosis are identically appears premature.

The total metabolism of all types of hypothyrosis is alike in essentials; differences are only in degree corresponding to the severity of the case. Measured in calories per kilo body weight, or per square meter body surface, the energy requirements are below normal. The disparity may be slight, as in mild cases of myxedema, and may amount to but 10 per cent; or marked, as in the case of cretinism of infants and postoperative myxedema (Talbor, Means), in which conditions the metabolism may be 40 per cent below normal. Calorimetry has not only added to our knowledge of these diseases but it offers also a method of establishing the diagnosis in doubtful cases.

Hypoglycemia has been noted constantly in athyria, both experimentally in animals, and clinically in myxedema and cretinism. Janney has called attention to a delay in the return of the blood sugar to normal after sugar is ingested. This prolonged sugar curve is not however peculiar to athyria but is manifested in several disorders of endocrine glands, as in Addison's disease and myopituitarism.

Nitrogen metabolism is disturbed in some interesting respects. Creatin, not normally found in human urine, is a constituent in the urine of cretins (also in case of infantilism and achondroplasia). The significance of this fact is obscure, because the metabolism of creatin is still uncertain. Both in cretins and in experimental athyria there is a decrease in the excretion of purins. Janney has suggested that "the normal level of purin metabolism is maintained by the thyroid."

CRETINISM

Little is known concerning the factors leading to the development of sporadic cretinism. It has been inferred, and probably with some measure of correctness, that thyroiditis occurring in early life is responsible for the degeneration of the gland, and instances are recorded where the malady developed following measles (juvenile myxedema). In some cases, however, the disease is undoubtedly present at birth. More than one case of cretinism may occur in a family. Peterson has reported an instance of this character. Insanitary modes of life of the parents have been assigned as a causal factor. Cretinism has been said to be more common in the

female, but Gordon states there is no difference between the sexes. The disease is seldom inherited since cretins are usually sterile. No evidence has been disclosed indicating that sporadic cretinism is more prevalent in one part of the country than another.

It is commonly accepted at present that there is no etiological distinction between endemic and sporadic cretinism; both alike seem to be due to impairment of function of the thyroid gland.

Endemic cretinism is found in all localities where goiter is endemic. There are some considerations which suggest that a disordered function of the thyroid in the parents is the cause of cretinism in the child. When families move from healthful into goitrous districts, the first generation may develop goiter, but not cretinism, while cretinism may occur in later generations.

Although it is commonly believed that sporadic cretinism is frequently congenital, the characteristic signs fail to appear in the early months of life. This failure has been attributed to thyroid secretion which the suckling infant derives from its mother's milk (Kocher). The earliest signs are the doughy swellings about the neck and shoulders, and defective growth. At an early age, also, there may be noted the swelling of the mucous membranes and of the tongue. The extremities lose their shape, the hands and feet become puffy and clumsy, and the legs bowed. In the earlier months of life the disease may be extremely difficult to recognize but at a later period the picture is characteristic. The swelling in the palpebral orifices, the saddle nose, swollen lips, with protruding tongue and prognathous jaw, the short, thick neck which does not support the head, the formless, undersized, and prominent abdomen make an unmistakable picture. The fontanels remain open for an indefinite period. The hair of the head is scanty and dry, and lanugo hair persists upon the forehead and shoulders. There is a remarkable delay in dentition until after the twentieth month in some cases, when the teeth appear at wide intervals and are prone to undergo rapid decay.

In early life the child can not sit or stand without support and learns to walk at a late period. Delayed development is most marked in talking, walking, and teething. There is always retarded mental development, which in degree depends upon the extent of thyroid involvement. All grades of mental deterioration are found, down to helpless idiocy. Cretinous children are always undersized, due to defect in the growth of the bones, and adult cretins are dwarfs seldom above 55 inches in stature. A peculiar nasal quality of the voice (cretinoid cry) is assigned to the infiltration of the nasal and laryngeal mucosa.

The subnormal metabolism has already been mentioned. There is a subnormal temperature, with cold hands and feet. The skin is

usually dry and sensible perspiration lacking. A marked sluggishness of the intestinal functions prevails, and persistent, obstinate constipation dating from birth, is said to be characteristic. No significant blood changes have been noted, but some degree of secondary anemia is usually found, and Langhans has described alterations in the bone marrow. Considerable variation in the picture of sporadic cretinism may occur, dependent upon the age at onset of the disease and the degree of athyria. The characteristic picture, however, in untreated cases is one of physical and psychic dwarfism.

In the majority of cases, suspicion of the nature of the condition is not aroused until the child is several months old. There may be no sign of abnormality until the first or second year, the disease being either dormant or perhaps acquired during the early months of life. The characteristic manifestations are evidences of physical and mental defect. The picture presented by typical cases can seldom be mistaken, bearing in mind the well known triad, stunted growth, mental dullness, and constipation.

MYXEDEMA

Myxedema was first described by Gull, but its relation to the thyroid gland was demonstrated by the brothers Reverdin, in 1882. Two primary causes of myxedema are recognized, one the operative removal of the thyroid, and the second, injury of the thyroid by some destructive process. The two conditions are essentially the same in that in both, the body is deprived of thyroid secretion (hypothyrosis). In the earlier days of the surgery of the thyroid gland, it occasionally happened that too much of the gland was removed. The symptoms following the operation were recognized chiefly by Kocher, as essentially comparable to those of spontaneous myxedema. A few instances of myxedema are recorded following excessive treatment of goiters with Röntgen rays (Malcom Seymour).

Primary myxedema is found more commonly in regions where goiter prevails, and this is due to the fact that many goiters undergo degeneration and atrophy of the secreting cells. It is said also that the disease has a familial tendency; mothers who show symptoms of hypothyroidism have hypothyroid children. McIlwaine reported the case of a woman who developed myxedema as a sequel to Graves's disease. She was treated for three years and improved. Later her first child was born. When the child was a year old it developed cretinism following a period of illness. The question arises in this case whether it might not have been this preceding illness which injured the thyroid.

Pronounced myxedema usually results in sterility; in the early stage of the disease pregnancy may occur and the child be a cretin.

Ebright mentions a woman who had two healthy children, then became affected with myxedema and had a cretinous child.

In contrast to cretinism, myxedema is more commonly found among women (Biedl). Symptoms of hypothyroidism develop most frequently about the time of the climacteric and most often in women who have had many children. In a few exceptional cases, a destructive lesion of the thyroid has been discovered as a cause of myxedema; Kohler has reported a case of actinomycosis of the thyroid and Neudorfer one of adenoma, each with myxedema as a sequel.

Of the remote factors which predispose to the disease, very little is known. It is occasionally a sequel of acute thyroiditis and has been observed to develop in children (juvenile myxedema), following infections, such as measles. In adults there are cases on record which have followed syphilis, but in an analysis of 370 cases of myxedema in children Gordon concluded that only a small per cent could be traced to syphilis. Lennmalm reported five cases of myxedema in syphilitic patients and it has been observed that improvement in these patients is slow and unsatisfactory under thyroid medication alone, but when vigorous antisyphilitic treatment is combined with thyroid a cure is often possible. A case of juvenile myxedema in a child born of a syphilitic mother did not improve on thyroid treatment alone but was restored to health when also treated for syphilis, although the Wassermann reaction in the child's blood was negative (Taylor). As has been mentioned, myxedema is occasionally a sequel to simple goiter, and there are cases recorded where Graves's disease has been followed by typical myxedema. Numerous toxic factors, alcohol, lead, "intestinal toxemia," have all been invoked as an explanation.

The thyroid gland invariably shows marked connective tissue hyperplasia together with fibrosis and atrophy of the acini, and may be reduced to one-tenth its normal weight. The gland is firm in consistency, pale and tough on section. In extreme cases, it may be difficult to find a normal appearing acinus in a microscopic section. Usually a few follicles remain, while the absolute number is very much diminished, and in adults a secreting remnant of the gland can frequently be detected. There is also reason for believing that the parathyroids are occasionally implicated in the disorder. In localities where goiter is endemic, tetany is not an uncommon complication of myxedema, and Victor Horsley described fibrotic changes in the parathyroids of a patient suffering from this disease. When the disease develops at an early age (juvenile myxedema) there is either cessation or retardation of the process of ossification. Cases are on record where the epiphyses of the long bones were united at the age of 20 and MacCallum dissected a case where the

bones of the sternum were separate. These changes can be detected readily by means of the X ray. There is not only a failure of ossification but the bones are smaller and the marrow cavity narrower.

The most striking change in myxedema concerns the subcutaneous tissue. The individual may appear fat or edematous, but the edema has been described as "solid"; that is, it does not pit on pressure. The subcutaneous tissues are notable for a marked overgrowth resembling granulation tissue, and the infiltration of a homogeneous material of a mucilaginous character.

One of the most significant problems in myxedema is the nature of the change in the tissues which produces the characteristic "solid edema" since this process accounts not only for the peculiar appearance of the patient but, extending throughout all the tissues of the body, possibly explains many symptoms.

The statement has often been made that myocarditis is a common sequel to myxedema. With a malady which develops most frequently in the fourth, fifth, and sixth decades of life some caution is required in assigning to it a causal relation to cardiac, vascular, or renal lesions which are also common at these same periods in life. Myocardial lesions, especially fibrous myocarditis, have been noted at autopsy in cases dead of myxedema, but whether these lesions are due to myxedema or any merely associated diseases is not clearly established. The same reserve must be exercised regarding arteriosclerosis and nephritis. Recalling the intimate relation that is supposed to exist between the functions of the thyroid and the pituitary changes it is of interest that pathological changes in this organ have been noted by Mott in association with myxedema. The pituitary is hyperplastic and there is some increase of colloid; the overgrowth concerns chiefly the pars intermedia, but may involve the pars nervosa. Analogous findings have been described by Hering in thyroidectomized animals.

The thyroid gland is very seldom totally destroyed by disease in adults, and there are all gradations in the severity of the symptoms, depending upon the amount of intact tissue. As a rule the disease develops slowly, the earlier symptoms often being changes in the mentality of the patients. The individual may become listless, he sleeps more than normally, he does not waken refreshed, and it is noted by his household that his memory is very poor. These symptoms may progress to a considerable degree toward mental deterioration before any peculiarity in the patient's appearance excites suspicion. Many cases are first seen by psychiatrists on account of this mental apathy. Concurrently with the mental disturbances, the patient complains of an indefinite sense of discomfort or a constant malaise, and although sleeping more than usual, there is a sensation of never feeling rested. In young adults the malady may develop

with great rapidity, so that the characteristic picture is noticeable in a few weeks. The pallor, puffy tissues beneath the eyes, the shortness of breath suggest renal disease.

Changes in facial expression are due to the infiltration of the skin and tissues of the face; the eyelids look puffy, the palpebral orifice is narrowed, the eyelids may be inflamed and the skin over the cheeks and chin becomes thickened. There is apparent thickening of the lips and the nose, with the result that a brutish and coarsened type of face develops. Next after the face the myxedematous deposits show in the neck and wrists and backs of the hands. The skin is dry and scaly and exfoliates as a powder, the nails are brittle, and the shape of the hands has been aptly described as "spadelike." The hair falls out and the axillary hair may be quite wanting in fully developed cases. The loss of hair above the forehead and on the nape of the neck and the outer third of the eyebrow produces a peculiar and characteristic appearance. The striking feature of myxedema is the characteristic "solid" edema of the subcutaneous tissues. An early increase in body weight falsely attributed to fat is due to this newly formed tissue. This swelling is noted earliest in those locations where the subcutaneous tissues are loose—the face and backs of the hands. The skin is yellowish, sometimes suggesting a jaundiced hue, occasionally of an alabaster whiteness. Areas of yellowish-brown pigmentation which disappear after the patient has received thyroid treatment have been described (Krantz and Means). This pigmentation usually affects the more exposed areas of the skin; face, neck, and forearms, less commonly the trunk and legs. It is irregular in distribution, brownish in color like that of Addison's disease, but does not involve the mucous membranes.

The changes described in the muscles are apparently responsible for the slow, sluggish movements and shuffling gait which are characteristics of the disease. Pains in the back and shoulders are common, and women complain of pain in the arms when doing up their hair; muscular cramps are usual. The muscles as a rule fatigue very readily; patients frequently complain that their legs give way on ascending the stairs.

In adults there is often soreness of the joints and relaxation of the ligaments, leading to flat foot and knock-knee. A peculiar gritting of the joints on motion has been described and the serious disturbance in nutrition is conspicuous in the tardy healing of fractures.

Presumably the cardiovascular symptoms may be attributed largely to the changes in the heart muscle. The symptoms are sluggishness of circulation, very much retarded pulse rate, and low blood pressure. Death from cardiac dilatation is not uncommon.

Interest in the subject of the heart in myxœdema was first aroused by the sudden deaths which occasionally occur during the early period of treatment. Hector Mackenzie called attention to this possibility years ago; fibrous myocarditis and sclerosis of the coronary arteries had often been noted at autopsies in these cases.

A number of abnormalities in the electrocardiogram have been described, T-wave negativity being the most common. Zondek noted this change in his cases. This abnormality in the T-wave may be confined to Lead I, or occur in all leads, when, of course, a more profound functional derangement is to be inferred.

Of the various cardiac complications of myxœdema which have been observed, one of the most interesting is angina pectoris. The first attack may occur after a period of thyroid treatment and when the signs of myxœdema are subsiding. Sturgis has reported a case of this kind. It may be impossible to administer thyroid in doses adequate for the control of the symptoms of myxœdema without inducing anginal attacks, though usually a smaller dose is well tolerated.

Since arteriosclerosis is so commonly noted in myxœdematous patients in middle life, and the heart muscle is often weak and diseased, it becomes necessary to use methods of examination of the circulation both before active treatment is begun and at periods thereafter until symptoms of the primary disease have disappeared and the proper dosage of thyroid gland finally determined.

Anæmia is one of the characteristics of the disease—in some cases the most prominent symptom. The blood picture is of the type of secondary anæmia with a decrease in all blood elements. In the older literature, types of anæmia were described (with reference especially to proportions of the various white blood cells) which were then thought to be characteristic of myxœdema, but with fuller knowledge these ideas have been abandoned. There is no constant blood picture in myxœdema; no relation between the blood and the duration of the disease, nor between the blood and the basal metabolism (Emery).

It seems quite possible that symptoms having their origin in a low functional tone of organs are, at least in part, referable to the anemia; especially would this be more likely in cases of long duration.

A peculiarity of the anæmia of myxœdema has been often remarked, namely, its persistence after the more obvious symptoms of the disease have vanished under treatment. The swelling melts out of the features of the face, the hair grows and the intellect clears, bodily vigor is restored, but anæmia may persist for months.

It is now generally recognized that the thyroid secretion exercises an important influence on the water balance in the tissues. The

physical state of the blood is altered by removal of the thyroid, since the viscosity increases and electrical conductivity decreases (Paladino); these changes have also been observed in the blood of patients with myxœdema and the total protein of the serum is increased from 5 to 9 per cent (Deutsch). These conditions represent a state of anhydræmia and it is, therefore, of interest that under the influence of thyroid medication the total blood volume may increase 25 per cent (Thompson). The decrease in plasma volume in myxœdema is associated with an accumulation of water, albumen, and salt in the tissues. In this condition the basal metabolism rate may be as low as 40 per cent. Minus 45 per cent is the lowest point ever observed.

HYPOADRENIA

In this condition the basal metabolism rate is much reduced, usually due to low nutritional states and anorexia, although the earliest symptom is usually asthenia, a systolic pressure of under 90 accompanied by a lowered basal metabolism rate is very suspicious of Addison's disease or hypoadrenia. The circulatory system is affected as it usually is in other diseases showing a lowered basal metabolism. There is a persistent hypotension, fever, irregular pulse, dyspnea, palpitation, vertigo, syncope, and cold sweat. As the disease continues there is progressive prostration.

Melanoderma is a prominent symptom. Patchy pigmentation of the face is very characteristic, but may also be on other exposed parts, or may be confined to the genital regions. A continuous dark brown line on the gums is very striking. The mucous membranes of the mouth are often pigmented. A positive dermatographical reaction is obtained when lightly stroking the skin over the abdomen with a blunt-edged instrument. Within a few seconds a pale line or band appears in the stroked area. This becomes more distinct and extensive. This white line stains its natural distinctiveness in one minute and lasts from two to three minutes more and gradually fades. This is spoken of as Sergent's "white adrenal line."

This disease is chronic but progressive. It first comes on insidiously. It usually occurs in patients of at least 40 years of age. The characteristic signs and symptoms are: A low basal metabolism rate, a low blood pressure, subnormal temperature, and low mentality.

DISCUSSION

Lowered basal metabolism is usually accompanied by hypotension but a low blood pressure is not only found in hypothyroidism and Addison's disease, but also following hemorrhage, in asthenic states (tuberculosis, carcinoma, anemia), in amyloid disease, in acute febrile conditions such as pneumonia, typhoid, etc. Apparently, it may be normal for some individuals, and is designated essential

hypotension. Patients with this condition are lethargic and have little endurance; their extremities are cold and cyanotic and the palms of their hands moist; they frequently suffer from mental depression, and commonly complain of dyspeptic symptoms and vague pains. These patients are often classed with the neurasthenics and their symptoms are largely those described during the World War under neurocardiac asthenia. Some authors believe that the condition may be brought about by the storage of an excessive quantity of blood in the splanchnic vessels.

Barach has shown that the incidence of hypotension (110 millimeters systolic pressure or less) is a constant finding; it is present in about 3.5 per cent of persons in apparent good health. He believes that such individuals are of distinctly asthenic constitution and that the specific cause of the hypotension is due to a poor respiratory apparatus and consequently inadequate oxygenation.

Hypotension has for many years been regarded as a cause for depressed mental and physical condition; life insurance companies have looked upon such individuals with suspicion; asthenia and neurasthenia have been assumed to be almost inevitable accompaniments of low blood pressure. Some authors have found that low blood pressure favors longevity, for it often occurs in the obese, the robust, and may be hereditary.

CONCLUSION

Any figure from plus 10 per cent to minus 10 per cent represents normalcy (a theoretical normal zone). Rates from minus 10 to minus 40 indicate decreased metabolic activity. Such rates prevail in myxedema.

Since the thyroid is the primary metabolism regulator it can readily be understood why the greatest changes in the metabolic rate will be encountered in connection with disease of the thyroid. The lowest rates prevail in cases of hypothyroidism. In myxedema the rates fall as low as minus 40 per cent.

Basal metabolism determinations are useful in the differentiation of the endogenous (endocrine) form of obesity from the exogenous form. The rate in the endocrine form is apt to be low. In the exogenous form of obesity the rate is either within normal limits or slightly above.

The majority of the endocrine diseases which are associated with hyposecretion are accompanied by lowered basal metabolic rates. This is more apt to be true if several glands are concomitantly involved. Such pluriglandular involvement when accompanied by a low metabolic rate will also be characterized by hypotension as well as decreased muscular and mental activity. Systolic and diastolic pressures are usually decreased proportionately.

BIBLIOGRAPHY

Arvay, A. von: Effect of thyroid and præphyson on basal metabolism and on specific dynamic action following thyroid extirpation and during avitaminosis. *Biochem. Ztschr.* 205: 433-440, 1929.

Barach, J. H.: Arterial hypotension, *Arch. Int. Med.* 35: 151, 1925.

Bokay, Z. von: Determination of basal metabolism in infants and children. *Jahrb. f. Kinderh.* 123: 10-17, February, 1929.

Cordier, V.: Clinical importance and Technic of estimation of basal metabolism. *J. de med. de Lyon.* 10: 169-171, March, 1929.

Delleplane G: Basal metabolism in benign and female genitalia. *Boll. de. Soc. Ital. di biol. sper.* 4: 115-118, 1929.

Basal Metabolism in menstrual cycle and in ovarian insufficiency; cases. *Ibid.* 110-115.

Kayser, C: Basal Metabolism as influenced by mean temperature of surroundings. *Compt. rend. Soc. de biol.* 101: 708-710, June 28, 1929.

Koehler, G: Effect of ovarian hormone on basal metabolism. *Klin. Wehnschr.* 8: 502-503, March 12, 1929.

Missal, M. S., and Johnson, M. W.: Failure of pituitary substances to influence basal metabolism or specific dynamic response to food in normal subjects. *J. Lab. and Clin. Med.* 14: 314-321, January, 1929.

McCartney, J. L. Dementia Præcox as an Endocrinopathy with clinical and autopsy reports. *Endocrinology.* 14: 73-87, January and February, 1929.

Langfeldt, G: The endocrine glands and autonomic systems in dementia præcox, J. W. Eides Boktrykkeri A. S. Bergen, 1926.

Bowman, K. M. Endocrine and biochemical studies in schizophrenia. *J. Nerv. and Ment. Dis.* 65: 465. 1927.

Niederwieser, V: Theory and practice of basal metabolism. *Wien. Klin. Wehnschr.* 42: 71-73, January 17, 1929.

Reid, W. D. and Kenway, F. L.: Electrocardiographic signs associated with low basal metabolism. *Endocrinology*, 13: 191-204, March-April, 1929.

Schadow, H., and Sehestedt, H.: Study of basal metabolism in fasting man (Starvation artist). *Arch. f. d. ges. Physiol.* 221: 571-575, 1929.

Schemsky, W. and Fink, M.: Examinations of basal metabolism in incretory disturbances of physiologic and non-physiologic origin. *Ztschr. f. d. ges. exper. Med.* 64: 95-110, 1929.

Smith, C. S., and Conto-e-Silvo, O. B.: Effect of massaging thyroid on basal metabolic rate of dogs. *Am. J. Physiol.* 88: 186, February, 1929.

Tangl, H., and Than: Effect of secretion on basal metabolism. *Arch. f. exper. Path. u. Pharmacol.* 139: 226-230, 1929.

Thompson, W. O. and P. K.: Significance of low basal metabolism following thyrotoxicosis. *Am. J. Surg.* 7: 48-54, July, 1929.

Vaccarezza, R., Silva, L. L., Alurralde, J., and Griot, C.: Correlation between basal metabolism and blood reaction. *Prensa med. argent.* 15: 1350, 1354, April 10, 1929.

Warren, C. W.: Clinical significance of low basal metabolic findings. *Clifton M. Bull.* 15: 161-170, July, 1929.

Womack, N. A., Cole, W. H., and Heideman, A. G.: Thyroid gland in infections: Effect upon basal metabolic rate. *Endocrinology*, 12: 773-790, November-December, 1928. •

Wuth, O.: Action of experimental alkalosis on basal metabolism in man. *Klin. Wehnschr.* 8: 969, May 21, 1929.

**RECENT STUDIES OF THE DERMATOPHYTES, INCLUDING A REPORT OF
EXPERIMENTAL INOCULATIONS OF MONKEYS (MACAQUES RHESUS)
AND GUINEA PIGS WITH TWO DERMATOPHYTES AND ONE BLASTO-
MYCOIDES¹**

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Heretofore hidden vistas of beautiful microscopic plants are now being revealed by the rediscovery of the relatively old science of mycology. Not that the body of man is just beginning to offer alluvial soil for the growth of pathogenic fungi, as apparently most fungi prefer a saprophytic existence, but that the constant development of all branches of science have aided in the recognition of previously unrecognized conditions. Exchanges of ideas and thoughts through better communication between medical men and the worthy cooperation of the mother science, botany, with its specific branch of mycology, have shown medical men the fertility of this field of science.

With these few thoughts in mind, an attempt is made to review here some recent developments in the studies of the dermatophytes and to give a report of some experimental work.

THE DERMATOPHYTES

The term "dermatophyte" will be used to include those fungi of a definite group which invade the hair and skin and produce therein pathologic conditions. It is generally understood that the *Trichophyton*, *Microsporon*, *Achorion*, *Endodermophyton*, and *Epidermophyton* constitute this group.

The subject will be arranged under the following headings:

1. *Nomenclature and classification*, bringing out these phases of research and experimentation which have a bearing on those subjects.
2. *Immune biological processes*, including recent reviews of immunological research work on the dermatophytes and their hosts.
3. *Mechanism of infection*, including reports of experimental studies on animals and humans, hematogenous inoculations, some histopathology, etc.
4. *Miscellaneous data*, containing certain methods of diagnosis, treatment, etc.
5. *Report of experimental inoculations*.
6. *Summary and conclusions*.

NOMENCLATURE AND CLASSIFICATION

Langeron and Ota (1) have offered a revision of the classification of the dermatophytes along purely botanical lines and in conformity with the International Rules of Nomenclature. This classification

¹This paper was submitted as a thesis in the School of Tropical Medicine, San Juan, Porto Rico, July, 1930.

has been accepted by Brumpt (2) and Bruns and Alexander (3). According to the authors of the nomenclature, these organisms are Hyphomycetes; Order, Conidiosporales; Suborder, Clostersporeae. By this arrangement the double, clinico-botanical classification of Sabouraud (4), although still considered convenient as a key to a natural classification, is changed. They distribute Sabouraud's species through six genera, preserving his original terminology for three and adding three new ones, Sabouraudites, Grubyella, and Bodinia.

Sabouraud (5) in his answer to Ota and Langeron's new classification stated that, in order to solve the problem of nomenclature, dermatologists should be mycologists and that such a dermatologist has not been found. For mycologists, dermatological nomenclature has no botanical value; and when the mycologists present a classification which seems to them more rational, the dermatologists will have none of it.

Again, as Sabouraud has stated, "There are two sides to every fungus causing a skin lesion; one a dermatological aspect, the other, a mycologic one. A dermatologist will never confuse a case of favus with ringworm of the scalp, although he is not a mycologist. He may make his cultures, point out the reproductive organs, and yet not know where to place the organism taxonomically. The mycologist sees only the cultures brought him. Clinical lesions do not interest him. He employs his time arranging the fungi in the order which seems rational for him, and does not worry about the lesion from which they came, nor even about their aspect in the parasitized tissue."

However, as Ashford (6) very ably analyzes the situation, "This is not a struggle over fundamentals, a squabble between scientists; one must finally recognize it as a clash between the highly cultured minds on tissues which are to determine the development of a nascent science with unfathomable future."

Castellani (7) defines the dermatophytes as follows: Class, Ascomycetes; order, Aspergillales; family, Gymnoasceae; tribe, Trichophytoneae, Castellani and Chalmers. There are eight members of this tribe. From the work of Nannizzi (8) (9) it would seem that Castellani was correct in his classification of the dermatophytes with the Gymnoasceae, as Nannizzi has successfully produced asci with the Sabouradite (*Achorion*) gypseum when sown in media rich in organic material. By the discovery of this ascophorous form, it is thought that the saprophytic origin of the tinea fungi is solved.

To complicate the problem of classification is the very enlightening article by Weidman (10) who shows how further studies of the very fundamentals of mycology should be applied to the parasitic fungi. He calls our attention not only to variability of fungi *in*

vitro but *in vivo*. Crowell (11) states that "One learns more and more that one can never hope to fully know a microorganism, either bacterium or fungus, in the fullest biologic sense until it has been followed through different environments, animal and otherwise. This statement pertains both to morphology and virulence; as is seen at present when dealing with several descendants of a single cell, one can not make a generalization to the effect that morphology has relation to virulence." Therefore, the possibilities of mutation complicating the morphologic criteria in the identification of species. Mellon (12), in working with one of the "Blastomycetes" found two different types of strains, one of which was easily recovered from young lesions and the other with difficulty from the older ones. In the course of time "secondary" colonies grew on the original ones; in the secondary ones special microscopic forms (including asci) developed which were altogether different from those of the primary colony; i. e., genetic changes had occurred. These secondary colonies were so dark that they were easily confused with contaminants.

An inquiry must also be made in medical mycology as to whether homothallism and heterothallism also obtain among the dermatophytes. This means that in a given fungus colony which has been derived from a single cell spore and is consequently a "pure line" strain, the fungus cell (thallus) might have qualities differing sexually without exhibiting any morphologic evidence of this difference. Starting with a pure line or monosporous culture if two such cultures are planted adjacent to each other, the resultant colony might be entirely free from certain special and distinctive fruit bodies (perithecia or asci), whereas the combination of two other colonies which had been reared in precisely the same manner would yield colonies which would produce asci. Thus the deduction, that one contained homogeneous sexes, either all males or all females, whereas the second contained heterologous sexes, both male and female.

Shear (13), working with rusts, demonstrated by mating, that 15 strains could be reduced to one or two. This shows again a possible explanation for some variabilities.

Weidman believes that, in the final analysis, future medical mycologists will be required to use monospore cultures, instead of sowing a large mass of fungus material in determining species. Nevertheless, heterothallism and homothallism may not apply to the dermatophytes.

IMMUNE BIOLOGIC PROCESSES

"In attempting to define biological terms and concepts, one is confronted with the fact that most terms used in biology defy un-

equivocal definition because, in the first place, biological phenomena are not discrete entities, but form a continuous series in which one entity grades into the next; and, in the second place, the terms used in a rapidly advancing experimental science are tentative and their meaning evolves with accumulation of new data." (Taliaferro) (14).

Hypersensitiveness is exhibited by individuals for a number of materials, such as pollens, serums, and drugs. Coca (15) defines hypersensitiveness as "A sensitiveness that is mediated by a special mechanism, which may be influenced by exposure to the exciting agent in the direction of lessened or increased sensitiveness." He gives five forms, two under normal, (a) serum disease (ordinary), and (b) dermatitis venenata, and so classifies them as normal because they may affect the majority of individuals of the species. Three are classified as abnormal. These are (a) anaphylaxis, (b) hypersensitiveness of the tuberculin type, and (c) atopy. They are classified as abnormal because they may affect individuals only if they happen to possess the proper previous exposure, and in the case of atopy, the proper inherited complex.

(a) *Local anaphylaxis: the Artus phenomena*.—This type of reaction follows the intradermal injection of a protein into a rabbit, anaphylactically sensitive to the protein, and seems to be one of local anaphylaxis; i. e., the antigen and antibody react locally at the site of injection. Clinically, it involves acute inflammation and possibly necrosis which takes time to develop, and thereby resembles the hypersensitiveness of infection reaction.

(b) *Hypersensitiveness of infection (Coca)*.—This type of reaction is exhibited in various bacterial and parasitic infections. The nature of the reaction can best be described by reference to the best known example of the type, the tuberculin reaction. The injection of tuberculin into the skin of a normal animal is followed by a few transitory microscopic changes at the site of injection, which disappear within a few hours. The same material when injected into the skin of a tuberculous person is not followed by any immediate reaction (unless the individual is also atopically hypersensitive), as in the hay-fever type of reaction; but after about 8 to 24 hours, an intense local inflammation occurs at the site of injection. The reaction is highly specific.

Allergy.—Doerr (20) has used the term "allergy" first introduced by von Pirquet, to signify all cases of altered reactivity (either increased or decreased), whether to antigenic substances or to non-antigenic materials. Apparently, in mycological literature, this term has been definitely limited to hypersensitiveness to antigenic substances.

(c) *Atopy, immediate skin reactions; protein wheals; atopic hypersensitiveness*.—These terms include certain conditions, notably

in asthma, in which small amounts of the exciting agent introduced intradermally by (a) rubbing the powdered exciting agent into superficial scratches on the skin, (b) placing an extract of the material on the skin and then making superficial scratches, or (c) injecting intradermally aqueous extracts of the material, is followed in hypersensitive individuals, by the formation of wheals of varying size, with irregular margins (pseudopods) surrounded by a zone of erythema. The reaction reaches its maximum in from 10 to 20 minutes.

In addition to mechanical injuries produced by fungi, there are undoubted toxic manifestations produced by absorption of toxic materials from the parasites. Whether the materials are (1) true toxins; (2) other poisonous substances, including endotoxins; or (3) proteins or protein products of the invader which are comparatively nontoxic to the normal host but become highly toxic to the host sensitized by infection remains to be fully determined.

The classification of toxic substances formed by disease-producing organisms have been divided into two large groups—the exotoxins or true toxins, excreted by the invading organism, and the endotoxins which are not excreted, but are retained until liberated through the disintegration of the invader.

True toxins.—Greenbaum (21) calls our attention to the fact that the *Trichophyton*s elaborate a toxin fatal to guinea pigs. The lethal dose of the filtered broth culture is about 4 cubic centimeters. Whether this toxin is a “true toxin” and animals can be immunized against it with the attending development in their serums of a demonstrable antitoxin, remains to be seen.

Endotoxins.—Endotoxins do not stimulate the production of antitoxins in the animal body, but rather such humoral antibodies as complement-fixing antibodies, precipitins, etc., which are obtained with natural proteins in general. These endotoxins can only be obtained through the disintegration of the invading organisms, and many substances worked on may be assailed as being protein digestive products (split proteins) which, though admittedly toxic, can not be called preformed specific endotoxins. Many of these so-called endotoxins turn out to be similar to tuberculin, which is apparently a protein or protein product of the invader, the toxicity of which rests predominantly upon previous sensitization and not upon primary toxicity.

The rôle of hypersensitiveness in the production of symptoms in the dermatomycoses.—The application of the knowledge of hypersensibility will aid in the understanding of the pathogenesis of skin lesions. Jadassohn (22) states that “the various lesions of different infections are varying manifestations of the battle between the skin and the organism. The absolute number of general processes which

can be caused by living organisms in the skin is limited, and it is astonishing how varied the clinical and histological manifestations become through the combination of these few basic processes. The determining factors for the resultant forms on the one hand are the specific properties of the organism, and on the other hand, the peculiarities of the skin and the general organism."

It is unknown why certain sites are particularly disposed or immune and why there is individual variability of sensitization and desensitization. Why the majority of cases take a typical course in spite of the great number of variable conditions that exist from disease to disease and from patient to patient is also unanswerable. Possibly this is because in both the host and the parasite those properties predominate which still keep within certain limits of variation, and through departure from these forms the atypical picture is produced. It is just these atypical pictures that can be approached through our knowledge of immunity.

Among the factors to be studied are (1) host resistance including his mechanism for defense, and (2) parasite reaction to the host.

In trichophyton infections, particularly of the scalp and beard, after penetrating the follicular apparatus, acute suppurative inflammation with destruction of the follicles and formation of granulation tissue ensues. The skin of the entire body now becomes allergic to trichophytin. This allergy is also the cause of the local reaction. Through all these factors, the characteristics of the deep trichophytic diseases are produced; namely, deep inflammation, quick destruction of the fungi, strong healing tendencies and but slight resistance to therapy.

The allergic reaction in the acute forms of the disease, especially the deep type, is adequate, as by it the fungi are eliminated and auto-inoculation prevented. Not only are trichophytids noted in the deep infections, but also in the superficial forms, more specially in the mycoses of the feet. Here the nonfungus-containing hand lesions are considered Dermatophytids. Jadassohn is unable to say whether in the trichophytids, which he thinks are undoubtedly caused by hematogenous infections of the skin, the fungi arrive in the skin which has already become allergic and excite their formation, or whether they were previously deposited in the skin and the reaction only occurs when the allergic state has reached a certain development. Due to the almost constant absence of fungi, the long duration and lack of peripheral growth, he feels the reaction is due to the deposition of endotoxins. The dermatophytes are keratophilous and this with the peculiarities of the blood vessels explains the predilection for follicular localization.

The relationship of immune biology to the morphology and course of the superficial infections is less clear and especially is it difficult to

explain the peculiarities of the mycotic infections of scalps of children and the spontaneous healing at puberty.

Ashford believes that there may be some substance, possibly elaborated by the glandular system, or possibly causing alterations in the reticulo-endothelial system, which appears after puberty and acts as an efficient deterrent to human trichophytia.

Reinoculation experiments in the superficial trichophyton infections of the glabrous skin have shown that skin sites which have healed shortly before gave positive results; however, reinfection usually takes place only in the surrounding, previously uninfected areas and even leaves free a peripheral zone 0.2 to 2 centimeters in breadth around the most external points that have been previously infected. This zone may show early acute inflammatory reaction but never develops trichophyton infection. A failure to find this zone occurs where some of the previous infection is still active. Other diseases such as syphilis and tuberculosis show these localized zones of immunity and this can account for some of the peculiarities of certain skin diseases. These zone reactions undoubtedly account for spontaneous healing of some of these infections as the fungi may die in the inner margin of the zone or may enter but create no pathologic reaction in the zone.

Animal experiments on intracardial reinfections have shown all intermediate forms of reaction from normal reaction to immunity, and in the middle of the scale there may appear types corresponding to trichophytids.

The presence of the allergic condition can be clearly demonstrated by the fact that all trichophytids show positive trichophytin reactions (Bloch (23)); i. e., the entire skin of the patient is hypersensitive to the application of the pathogenic fungi and their toxin, trichophytin, thus showing a general and not a local condition.

The individual lesion of the trichophytids represents an inflammatory reaction of the allergic skin to the trichophytic antigen.

Rivalier (24), from the study of guinea-pig infections produced with highly pathogenic trichophytons, found profound tegumental and systemic alterations of the allergic type. Immunity in the strict sense did not occur. The cutaneous manifestations of allergy, he considered to be a sufficient explanation of the response of the animal to the second attempt of reinoculation, and there is perfect accord between degree of resistance to new infection and intensity of allergy. The greater the sensibility, the more marked the cutaneous reaction to infection, and vice versa.

MECHANISM OF INFECTION

According to some dermatologists, many infectious diseases are divided into two groups: (1) Those in which the primary lesion ap-

pears at the point of infection, and (2) those in which hematogenous lesions appear in the skin under allergic conditions.

In studying those dermatophytic lesions which are allergic in nature, it becomes necessary to determine how the infection reaches the lesions and, if possible, to determine if these lesions are produced by (1) hematogenous distribution of fungi or fragments of fungi, (2) only their toxins, or (3) both.

It has now been clearly demonstrated in experimental animals that fungi are distributed hematogenously and cause skin lesions. Saeves (25) was the first to introduce the *Achorion quinckeanum* and the *Trichophyton gypseum* intravenously with the development of disseminated cutaneous lesions. Many others, including Jessner (26), Jadassohn (27), and Kogaj (28) experimented in this field. Kogaj, with hematogenous injections, could localize lesions in any part of the skin by trauma at the desired site. Ambrosoli (29), Passini (30), and Sutter (31) have been able to obtain positive blood cultures of the dermatophytes in trichophyton infections. Jadassohn demonstrated that fungi from primary lesions of the skin enter the blood almost immediately. Sulzberger (32) found, after experimental cutaneous infections of guinea pigs, that there are two positive and one negative phase in blood cultures: (1) The first positive phase one hour to two days after infection, (2) a negative phase from the third to the ninth day, inclusive, and (3) the second positive phase, 9 to 11 days following infection. This Sulzberger considers important for the conception of pathogenesis of trichophytic eruptions. It is shown that following the elapse of a certain time interval after the primary infection, a hematogenous dissemination of fungi takes place which can (directly or indirectly) only originate from the primary lesion. This surely is not spontaneous and not from rubbing. The negative phase is precisely the period in which the primary lesion reaches the height of its inflammatory reaction, the allergy is at its maximum, the spontaneous involution begins, and fungi begin to disappear from the primary area. The same fundamental, biologic mechanism—i. e., allergic process—exists in both.

Hanawa has shown that at this time, and due to the strength of the allergy, great morphologic changes take place in the tissues of the primary lesion. Not only marked inflammation, but even necrobiosis, leading to demarcation and throwing off fungi to the outside, but it also favors the thrusting of the fungi toward the inside, the blood stream.

Jadassohn (33) defines hematogenous dermatoses as "those diseases in which the agent causing the disease is brought, by the blood, directly to the skin and there causes its corresponding manifestations"; he defines toxic dermatoses as "those diseases in which sub-

stances in solution affect the skin, without it being demonstrable that these substances are deposited there."

The hematogenous origin of certain dermatomycoses, as trichophytosis, favus, epidermatophytosis, and infections by the microsporon, is fairly well established by some of the aforementioned studies on humans as well as by laboratory experimentation. The exogenous origin of the primary lesions and lymphogenous infections also must be remembered.

Trichophytids are hematogenous infections of the skin modified by allergy and are found, as is to be expected, mainly on the deep trichophyton infections.

Jessner and others have demonstrated a special effect of serum of the allergic persons on the trichophyton fungi, and also have shown that fungi coming from the skin lesions differ in their cultural characteristics from those derived from the glands or the blood of the same patient.

Present opinion is that allergy kills or eliminates fungi, because the allergic skin reacts even to the smallest amount of exotoxin produced by parasites that die in the living tissue as well as in the culture. In such sites, the endotoxin continues to act for some time as is seen in the trichophytids.

Through the histology of primary lesions of syphilis, it has been shown that microbes enter the open blood vessel. Thus, the differences in the structure of the pathologic processes (granulation, necrosis, organization of thrombi, etc.) can determine the frequency of blood infections. These pathologic processes are themselves dependent on the type and development of the reaction, which differs according to both the individual and the type of microbe. In this, there are factors which, on the one hand, influence the mobilization of the microbes and favor their deposit in the skin, such as traumas, passive and active hyperemias, and acute inflammation; and, on the other hand, sensitize and weaken the resistance of the organism as a whole. Sometimes both factors are present.

The histopathology of hematogenous infections is very important, especially the knowledge as to where the skin is invaded. For both clinical and anatomical reasons, localization in the blood vessels of hematogenous dermatoses is not constant. Follicular localization is very frequent in the trichophytids, possibly because the follicular apparatus has certain immune biological peculiarities, for in ectogenous trichophytic infections the fungi can remain in the follicles and there be pathogenic for a certain period of time after the superficial epithelium has healed, free from fungi and (temporarily) immune. Particularly in lichenoid trichophytid one has to think that the fungi which are deposited in the follicular vessels are relatively

near the horny substance; they can therefore reach their favorite medium after a short passage through the living cutis in which they find it difficult to thrive.

MISCELLANEOUS DATA

Ehara (35) discusses inoculation experiments of different types of trichophytons in the testicles of rabbits. One-half cubic centimeter of an emulsion (1:10 in distilled water) of the different trichophytons are inoculated. Scrotal sac edema occurs within 24 hours and the parenchyma becomes indurated. Both subside within 24 hours. Histologically, marked necrosis was found at the site of injection. In the trichophyton infections of animal origin, the mycelium can be demonstrated from 3 to 10 days after injection. Those trichophytons of human origin are demonstrated as early as the second day but disappear on the sixth to eighth day.

Sulzberger (36) discusses Cleveland White's article (37) on Auto-inoculation Dermatomyces from Toe Cultures of Human Volunteers. *Trichophyton interdigitale* was isolated and used for the auto-inoculation. The inoculation took, reached the acme on the seventh day, and then began to regress. Up to the seventh day after inoculation, hyphenated fungi were found, but after then they disappeared.

This was compared with experimental inoculations of guinea pigs on the scarified skin with massive doses of *Achorion quinckeanum*. Three to four days after inoculation, slight reaction is noted and is more than could be accounted for by trauma. Hyphenated fungi are demonstrable. Infection develops on the fifth to the tenth day and reaches its acme on the ninth to the tenth day. During this time hyphenated fungi in increasing numbers are easily demonstrated. However, after clinical acme, few, if any, of the hyphenated fungi are present and these rapidly disappear. About this time (tenth day) the skin of the guinea pig becomes allergic to trichophytin, and the theory is that the allergy causes the fungi to disappear.

After the acme, White in his clinical cases, and Sulzberger with guinea pigs, have noted a few nonhyphenated fungi. Are those morphologically changed fungi saprophytes or secondary invaders, and does mutation account for these changes?

TREATMENT

Apparently the most outstanding development in chemical treatment is in the use of the thallium salts for tinea of the scalp. Thallium acetate seems the preferred salt. Many articles are being written about its use, and Felden (38) gives an excellent bibliography of the subject.

White (39) covers the subject of treatment of the dermatomycoses very thoroughly, and Greenwood and Swartz (40), in the review of literature, bring this subject up to date.

Much argument pro and con appears in reference to the use of trichophytin in immunization and treatment. Strassberg (41) believes complete immunization in man against trichophytosis is unattainable but that trichophytin accelerates recovery of deep mycotic ulcers. Fuhs (42) prepared digests of trichophyton cultures according to Joannovics and injected them into 26 cases of infection with this fungus. The digest was found to be effective and therapeutically equivalent to the trichophytins of Block, of Bussen, and of Scholtz. It differs from these, however, in causing progressive dry resorption of infiltrations and almost complete absence of an observable inflammatory focal reaction. Markert (43) shows that patients with trichophytosis almost always react to intracutaneous injections of 1:5 dilution of Trichosykin-Kalle and Trichophytin-Hoechst by a local erythema and infiltration. The reaction is like the tuberculin test in specificity and in time of maximum reaction (36 to 48 hours). Jausion and Sohier (44) employed a polyvalent vaccine and filtrate with favorable results obtained from the former. Quick cures of nine cases of mycotic infections (kerion, inguinal, and axillary mycoses, etc.) are reported. Trichophyton of the glabrous skin rapidly recedes under treatment. The same results were obtained in mycotic eczemas, such as the so-called parakeratosis psoriasiformis. Rivalier (45) considers that prevention and curative treatment with trichophytin is fruitless. If it has any effect, it would produce a diminution of allergy and therefore a lowered resistance to infection. Eugwer (46), in studying the serum of patients with deep trichophytosis and positive complement fixation of the blood, demonstrated certain bodies (anti-cutins) which inhibit allergic reactions. This explains the curious phenomena in these cases of a weak or negative allergic reaction.

Weidman and Chambers (47) have demonstrated a fungi static strain of *Bacillus subtilis* isolated from normal toes which inhibits 11 species of fungi, including *Trichophyton interdigitale*.

EXPERIMENTAL INOCULATION OF MONKEYS (MACAQUES RHESUS AND GUINEA PIGS
WITH TWO DERMATOPHYTES AND ONE BLASTOMYCOIDES

In a recent study by Kesten (48), conducted in one of the largest clinics in Porto Rico, it was determined that (omitting banal pigment anomalies) fungus infections formed 51 per cent of the skin lesions seen in the island. That fungus infections of the skin are very common in Porto Rico has seemed apparent for some time but no exact figures have been available until the work of Kesten men-

tioned above. The problem has seemed of such importance that the writer felt that efforts should be made to study it in a more fundamental way. Accordingly, experiments were planned involving the experimental inoculation of animals in order to determine if certain of the fungi could be made to infect laboratory animals, as guinea pigs and monkeys, and to see what could be learned regarding the mechanism of immunity in diseases of this nature. In this paper the results of the first part of the work are reported.

Working with the dermatophytes, Bloch (49) in 1908 stated that the subcutaneous or intravenous methods of infection with fungi do not immunize or reproduce disease in animals. Lombardo (50) also failed to produce any reactions to the *trichophyton* when this fungus was introduced into animals in any other way than through the skin. Miliary granulations, however, were described in the lung of a rabbit following the subcutaneous and intravenous injection of *trichophyton* and *Oospora canina* in a series of experiments performed by Sabrazés (51). Similar lesions were also found by Bukowsky (52) with *Achorion*. Saeves (53) produced cutaneous lesions in a guinea pig with *trichophyton gypseum* and *Achorion quinckeanum* by intracardial injection in animals which had been previously shaved on the abdomen. This work was confirmed and further extended by Kogaj (54). In a recent paper Fried and Segal (55) summarize the literature and report the successful infection of rabbits with *Trichophyton gypseum*. These authors shaved the skin of the animals and then scarified with sandpaper. The rabbits were then injected intravenously with from 2 to 5 c. c. of an emulsion of *Trichophyton gypseum*. Of 29 animals injected, 11, or 38 per cent, developed cutaneous lesions confined to the shaved and scarified areas only. The authors state that the bulk of the fungus disappears within the first 24 hours.

Since *Trichophyton asteroides* is a variety of trichophyton which affects chiefly lower animals (horses and cattle) and gives rise to inflammatory lesions with folliculitis and the formation of kerion, it was thought this fungus would be a most favorable one to work with for the purpose in mind. In addition, there was available an interesting *Blastomycoides (Coccidioides) aurea* recently isolated from a subcutaneous abscess in a negro who was presented at one of the clinics by Dr. García Cabrera. The patient presented severe ulcerative lesions and subcutaneous collections of pus over the inner aspects of the thighs and buttocks with extensions into the groin. Pus was withdrawn with a sterile hypodermic syringe from a closed deep abscess and planted on Sabouraud's glucose medium. Golden-orange colonies appeared in from four to five days which were very translucent, round, convex, and of a beeswax consistency and ap-

pearance without duvet. For the third fungus *Sabouraudite rubra* (Castellani) Langeron was employed.

The *trichophyton* was sown in several tubes of 4 per cent glucose broth (pH₇) and upon Sabouraud's glucose agar in giant culture. After a 10-day growth had been obtained the fluffy deposit and superficial growth in the glucose broth tubes were removed and ground with sterile sand in a mortar. The ground material was then suspended in physiologic saline. Microscopical examination of the emulsion revealed an abundance of spores and mycelia. The *Blastomycoides* and cultures of *Sabouraudites rubra* were treated in the same fashion.

EXPERIMENTS WITH TRICHOPHYTON ASTEROIDES GYPSEUM

Several methods were devised to infect monkeys. In each animal three methods were employed at the same time with the hope that at least one would succeed. Two cubic centimeters of Sabouraud's glucose agar was melted, cooled to 43° C., and injected hypodermically in monkeys 1 and 2 in each armpit and right groin. Into the nutrient mass was immediately injected 1 c. c. of an emulsion of *Trichophyton asteroides gypseum*, prepared as described above. On the left side of the shaven abdomen a pocket was dissected subcutaneously and a piece of the growth in giant culture approximately an inch square was inserted therein, the wound being closed thereafter with collodion. Finally, on the right side of the abdomen, the skin was brusquely rubbed with sandpaper over an area of 1½ inches by 3 inches until a sero-sanguinous exudate had left the surface humid. Into this area 1 c. c. of the *Trichophyton asteroides* emulsion was rubbed with sandpaper.

Twenty days later, monkey 1 presented a mass about the size of a small chestnut in the right groin at the site of inoculation. This mass was rounded, indurated, and smooth, with the feel of an enlarged lymph gland. The skin over this mass was slightly reddened. A similar mass about the size of a pea was noted in the left axilla at the site of the previous inoculation. No other lesions were present. Monkey 2 showed slight induration in the region of the pocket on the left side of the abdomen where the fragment of a giant culture was planted. A small indurated smooth mass was also noted in the right groin. No other lesions were present in this animal.

On the twenty-sixth day following inoculation monkey 1 showed no further change but monkey 2 presented on the right side of the abdomen, where the culture had been rubbed into the skin with sandpaper, a large, irregularly shaped, festooned patch, about three-quarters to 1½ inches in extent. The lesion was slightly elevated, indurated, and presented a dull, red center. The periphery was clearly delimited

from the surrounding skin by a slightly elevated ridge and showed a little desquamation. In addition there were secondary and smaller patches in the vicinity of the main lesion. Skin scrapings were soaked in 40 per cent potassium hydrate solution and were found to be heavily invaded by *Trichophyton asteroides*. This was further demonstrated to be the case by cultures. In three days, plate cultures of the squames showed some 30 stellate, cream-colored, translucent colonies of a silky sheen. There were only one or two contaminating bacterial colonies. On the next day, by direct examination of these plate colonies with the high, dry lens, each was found to be composed of a mass of mycelial filaments, radiating at the periphery. A few aleuries, a few loose spirals, and a very few chlamydospores were noted. There were no fusiform bodies. The mycelium was usually straight, at times undulating. Some of the original scales were soaked in alcohol for half an hour and individual scales were inoculated in Sabouraud's glucose agar. All gave the same type of colonies, but there were no contaminating bacteria.

On the thirty-fourth day monkey 1 showed no changes from the conditions described for the twentieth day, but the skin lesions of monkey 2 had become accentuated.

On the seventy-first day monkey 1 also showed definite skin lesions on the right side of the abdomen where the culture had been rubbed into the skin with sandpaper. These lesions were identical to those described for monkey 2. The lesion of monkey 2 had persisted, but the squames were more abundant and gave a pearly cast to the eruption. No other lesions were found.

On the ninety-ninth day after inoculation the lesions of both monkeys had practically disappeared.

On the fifty-second day of this experiment, 10 guinea pigs, whose abdomens had been shaven 24 hours previously were inoculated with cultures obtained from monkey 2 by sandpapering the abdomen and rubbing the emulsion into the skin. Twenty-three days later five of the guinea pigs were living, and two of the animals, which had died of pneumonia, were found to have lesions at the site of inoculation identical to those produced in the monkeys. Scrapings from the lesions revealed spores and mycelia on direct examination and subcultures proved to be *Trichophyton asteroides*. The other three guinea pigs had died before lesions had time to appear. Autopsies of the two dead guinea pigs with lesions of the skin revealed no other lesions save those of pneumonia. Fragments of lung, spleen, liver, and kidney were negative for *Trichophyton asteroides*.

EXPERIMENTS WITH SABOURADITES RUBRA (CASTELLANI) LANGERON

Exactly the same methods and technique were employed in the inoculation of monkeys with *Sabouradites rubrum* as described for

the *trichophyton* above. Monkeys 3 and 4 were inoculated on the same day as monkeys 1 and 2. Twenty days later monkey 3 presented only an enlarged gland in the right groin at the site of inoculation. No other lesions were visible. Twenty-six days after inoculation no change was noted in monkey 3. Monkey 4 had escaped at the time of the first examination, but on this occasion showed no lesions whatever. Thirty-four days and 72 days after inoculation no lesions were visible in either monkey. (It should be stated that all of the animals were examined daily in their cages but were only removed for special examination as indicated when the cage examination revealed anything suspicious which demanded closer survey.) One hundred and eleven days after inoculation monkey 3 died. The findings at autopsy were unimportant since it was found that the animal died of pneumonia and tuberculosis. Cultures from the lungs, liver, spleen, kidney, and skin at the site originally inoculated were all negative for *Sabouradites rubra*.

EXPERIMENTS WITH BLASTOMYCOIDES (COCCIDIODES) AUREA

This organism was sown and emulsified, as were the *trichophyton* and *Sabouradites rubra*, and two monkeys were inoculated in the same manner as described before. (Monkeys 5 and 6.)

Twenty days following inoculation monkey 5 presented a mass in the right groin. The overlying skin was reddened. Similar but smaller masses were noted under each axilla at the sites of inoculation. The pocket evacuated in the abdominal wall showed induration, and the wound was found to be gaping, revealing grayish, necrotic material within. The area on the right side of the abdomen showed some thickening and induration. In addition, the general condition showed sepsis. The animal was definitely ill and depressed. One cubic centimeter of glucose broth was injected into the groin lesion and withdrawn immediately thereafter without disturbing the needle. This fluid was sown on plates.

Monkey 6 showed lesions identical with those of monkey 5. On the twenty-sixth day both monkeys showed improvement over the sandpapered area which, however, had never been the seat of any distinct eruption. The pocket in the abdomen had closed, and the glandular lesions remained as before. Fluid was again injected, withdrawn, and plated.

On the seventy-first day monkey 5 revealed no lesions and monkey 6 only an enlarged gland in the right groin which was excised, emulsified in an aseptic mortar, and sown on Sabouraud's glucose agar. All cultures from these glands were doubtful as far as the original organism was concerned. Yeastlike bodies were found in abundance, but could not be separated from a contaminating coccus,

and were finally lost. But the colonies from the first were brownish yellow and seemed to promise from this cultural likeness a positive culture.

The morphology and cultural characteristics of this fungus will be reported in a subsequent paper by Ashford. The outstanding features, however, are many mycelia, many arthrospores, and some large, very heavily shelled, round bodies containing sporelike bodies.

CONCLUSIONS

These studies indicate the experimental transmission of infection in monkeys and guinea pigs with the *Trichophyton asteroides gypseum* by at least one of the methods employed. Negative results were obtained with *Sabouradites rubra* in monkeys with the same method. The pathogenicity of *Blastomycoides aurea* falls short of proof from the failure to secure positive cultures, but this question is still open.

It seems apparent that experimental transmission of infection with *trichophyton* can not be accomplished at the point of inoculation by introducing the fungus under the skin. Infection is successful when the fungus is introduced in the superficial layers of the skin, and it would seem a safe statement to make that this fungus possesses definite dermatotropic properties. Also it is known that greater growth of this fungus is obtained in an environment rich in oxygen (56). Preference for the skin can not be explained entirely upon this basis since it also grows to some extent when the environment is comparatively limited in oxygen. Fried and Segal have reported the successful transmission of this fungus infection to rabbits but of chief interest is their statement that in over a third of the cases of rabbits inoculated by marginal ear vein with this organism, a typical dermatomycosis was only obtained on previously abraded skin. The analogy is the more striking in that lesions appeared on the skin in their animals at about the same periods of inoculation as in the above experiments. These authors suggest that infection following intravenous injection takes place after injury of the skin because the fungus is able to migrate from the injured papillary capillaries into the skin where it develops its pathologic properties. This is a quite logical explanation of the phenomena observed, but it is also suggested that the dermatrophism of the fungus is also an important factor, and that to some extent the oxygen supply available is also a contributing factor favoring infection of the skin.

SUMMARY

Langeron and Ota have offered a revision of the classification of the dermatophytes along purely botanical lines and in conformity with the International Rules of Nomenclature. Sabouraud believes

this mycological classification inadequate for the needs of the dermatologist. Castellani differs from the aforementioned by placing the dermatophytes with the gymnoasceae instead of with the hyphomycetes. Nannizzi has produced asci with the *Sabouradite* (*Achorion*) *gypseum*, as well as with other dermatophytes when sown on a media rich in organic matter. This would tend to substantiate Castellani's arrangement. However, this work of Nannizzi should be confirmed. Weidman further complicates the problem of classification by calling our attention to the variability in vivo as well as in vitro. Also, the question of mutation, heterothallism and homothallism are brought out. How much these factors have a bearing on the study of the dermatophytes remains to be seen.

Immune biologic processes in dermatomycoses have attracted the attention of the dermatologist as well as the research workers in the field of mycology. Through clinical studies and laboratory investigation, it is now possible to interpret some of the peculiarities of the atypical skin reactions in infections with the dermatophytes. The allergic reactions seen in deep and superficial lesions are explained by Jadassohn. Apparently immunity in the strict sense does not occur, but evidently the allergic reaction is part of the defense mechanism of the body and is the same or similar to the so-called "hypersensitiveness of infection" (Coca). Some have compared it with the "tuberculin reaction."

The mechanism of infection in dermatomycosis is also an important subject for research. Here, again, clinical and laboratory studies have given some clues. Many authors feel that the dermatophytic lesions which are allergic in nature are produced by hematogenous distribution of (1) fungi or fragments of fungi, (2) their toxins, or (3) both factors. Much evidence is being accumulated to confirm the hematogenous theory of distribution of these lesions, and Sultzberger has shown a late, second positive phase in blood cultures in dermatomycoses. The follicular localization of the lesions in some of these cases is fairly well established. This is explained on the basis of the preference of the trichophytia for the horny layer of the skin.

The use of thallium salts in the treatment of tinea of the scalp has been described by many authors. Immunization and treatment by trichophytin has some advocates and enemies. The exact value of this substance is hard to estimate because of the many conflicting reports.

A report of experimental transmission of *Trichophyton asteroides gypseum* to monkeys and guinea pigs is given. Also the failures of transmission of the *Sabouradites rubra*, as well as some studies made on the *Blastomycoides* are reported.

It is hoped that the pure science of mycology may aid us in a better classification of pathogenic fungi and, by even closer cooperation between the dermatologist, the mycologist, the immunologist, and those engaged in experimental research work, we may have a better understanding of the pathogenic processes produced by them.

BIBLIOGRAPHY

1. Langeron, M. and Ota: Nouvelle classification des dermatophytes. *Ann. de Parasit.*, 1923, 1: 305.
2. Brumpt, E.: *Précis de Parasitologie*, 1927, Masson et Cie., Paris.
3. Dermatomykosen. Vol. XI. *Handbuch der Haut und Geschlechtskrankheiten*. Published by Julius Springer, Berlin, 1928.
4. Sabouraud, R.: Sur la classification botanique des dermatophytes. *Ann. de Parasit.*, 1924, 2: 172.
5. Sabouraud, R.: Concernant les classifications proposées pour les dermatophytes. *Ann. de Parasit.*, VII, 3: 228.
6. Ashford, B. K.: The Significance of Mycology in Tropical Medicine. In press in *Arch. Dermat. & Syph.*
7. Castellani, A.: Fungi and Fungous Diseases.—Lecture 1. *Arch. Dermat. & Syph.*, 16: 383 and 571; Lecture 2. *Ibid.*, 17: 61; Lecture 3. *Ibid.*, 17: 194; Lecture 4. *Ibid.*, 17: 354.
8. Nannizzi, Arturo: Recerche sui rapporti morfologici e biologici tra gymnoascaceae e dermatomiceti. *Ann. Mycologici*, 24: (1/2) 85.
9. Nannizzi, A.: Recerche sull' origine saprofitica dei funghi del tigne II *Gymnoascus gypseum* sp. n., forma ascofora del *Sabouradites (Achorion) gypseum*. *Atti. R. Accad. Fisiocritici Siena*, 2: (1/3) 89, 1927.
10. Weidman, F. D.: Lights from the Botanical Field on Medical Problems. *Arch. Dermat. & Syph.*, 19: (6) 867, 1929.
11. Crowell, M. J.: *J. Bact.*, 11: 65, 1926.
12. Mellon, R. R.: Studies in Microbic Heredity. VI. The Infective and Taxonomic Significance of a Newly Described Ascospore Stage for the Fungi of Blastomycosis, *J. Bact.*, 11: 229, April, 1926. VII. Observations on the Genetic Origin of the Several Types of Fungi Found in the Lesions of Blastomycosis Hominis, *ibid.*, 11: 419, June, 1926.
13. Shear, C. L., and Dodge, B. O.: Life Histories and Heterothallism of the Red Bread Mold Fungi of the *Monilia Sitophila* Group. *J. Agric. Research*, 34: 1019, June, 1927.
14. Tallaferro, W. A.: *The Immunity of Parasitic Infections*. The Century Co., N. Y., 1929, pp. 200.
15. Coca, F. A.: *Essentials of Immunology for Medical Students*. Baltimore, Williams & Wilkins, 1925, pp. 94.
16. Long, E. R.: Tuberculin and the Tubercular Reaction. In Jorden & Falk. *The Newer Knowledge of Bact. and Immunol.*, pp. 1016-1034.
17. Wagener, E. H.: A Skin Reaction to Extracts of *Leishmania tropica* and *L. infantum*. *Univ. Calif. Pub. in Zool.*, 20: 477-488.
18. Bachman, G. W.: A Precipitin Test in Experimental Trichiniasis. *Jour. Prev. Med.*, 2: 35-48, 1928.
- Same author: An Intradermal Reaction in Experimental Trichiniasis. *Ibid.*, 2: 513-523.
19. Coventry, F. A. Hypersensitiveness to Helminth Proteins. 11. Cutaneous and Precipitin Tests with *Ascaris* Extracts in Infected and Immunized Animals. *Jour. Prev. Med.*, 3: 43-62.

20. Doerr, R., and Berger, W.: Beziehungen Zwischen Virulenz und Vermehrungsgeschwindigkeit der Egger. *Klin. Wchnschr.*, 1: 628, 1922.
14. Talliaferro: pp. 216.
21. Greenbaum, S. A.: On the Biological Properties of Pathogenic Molds. *J. Infec. Dis. Chicago*, 1922. 31: 26-31.
22. Jadassohn, Josef: The Importance of Immune Biologic Processes in the Morphology of Skin Lesions. *Arch. Dermat. & Syph.*, 22: 355, March, 1930.
23. Bloch, Bruno: Zur Lehre von den Dermatomykosen. *Arch. f. Dermat. u. Syph.*, 93: 157, 1908.
24. Rivallier, E.: Experimental Investigations on Allergy and Immunity in Trichophyton Infections. *Ann. de dermat. et syph.*, 10: 618, June, 1929.
25. Saeves, I.: Experimentelle Beitrage zur Dermatomykosenlehre. *Arch. f. Dermat. u. Syph.*, 121: 161, 1916.
26. Jessner, M.: Zur Pathogenese der Trichophytide. *Arch. f. Dermat. u. Syph.*, 136: 416, 1921.
27. Jadassohn, W.: Beitrag zur Genese der Allergie bie Impfmykosen. *Arch. f. Dermat. u. Syph.*, 153: 476, 1927.
28. Kogaj, F.: Experimentelle Beitrage zur Lehre von den Dermatomykosen. *Arch. f. Dermat. u. Syph.*, 150: 331, 1926.
29. Ambrosoli, G. A.: Coltura di *Trichophyton gypseum* del sangue circolante in trichofizia profunda con *Lichen trichophytitus*. *Giro. ital. d. mal. ven.*, 66: 233, 1921.
30. Passini, A.: Zur Trichophytonkultur aus dem zirkulierenden Blute bie Trichophytiden. *Arch. f. Dermat. u. Syph.*, 140: 369, 1921.
31. Sutter, E.: Zur Kenntis der Pathogenese der Trichophytide. *Arch. f. Dermat. u. Syph.*, 127: 735, 1919.
32. Sulzberger, M. B.: The Pathogenesis of Trichophytids.—The spontaneous passage of formed elements (spores) from the primary lesions into the circulation blood. *Arch. Dermat. & Syph.*, 18: 891, 1928.
33. Jadassohn, Josef: Hematogenous Infectious Diseases of the Skin. *Arch. Dermat. & Syph.*, 21: 526, 1930.
34. Cleveland, D. E. H.: "Wood Light" in Dermatological Diagnosis (with special reference to ringworm). *Arch. Derm. & Syph.*, 18: 368, September, 1928.
35. Ehara, I.: Inoculation of Different Types of Trichophytons in the Testicles of Several Rabbits. *Japan J. Dermat. & Urol.*, 27: 13, September, 1927.
36. Sulzberger, M.: *Arch. Dermat. & Syph.*, 20: 875, December, 1929.
37. White, Cleveland: Auto-inoculation Dermatomycoses from the Toe Cultures of Human Volunteers. *Arch. Dermat. & Syph.*, 20: 315.
38. Felden, B. F.: Epilation with Thallium Acetate in the Treatment of Ringworm of the Scalp in Children. *Arch. Dermat. & Syph.*, 17: 182.
39. White, C.: Fungus Diseases of the Skin.—Clinical aspects and treatment. *Arch. Dermat. & Syph.*, 15: 387, 1927.
40. Greenwood, A. M., and Swartz, J. H.: Under 39, pp. 404.
41. Strassberg, M.: Zur specifischen Behandlung der Tiefen Trichophytie. *Wien. klin. Wchnschr.*, 34: 60, 1921.
42. Fuhs, H.: Ueber die Therapeutische Wirksamkeit eines durch Verdauung von Trichophytonkulturen Gowonnenen Präparates (Joannovics). *Wien. klin. Wchnschr.*, 33: 653, 1920.
43. Markert, H. J.: Experimentelle Untersuchungen über die Diagnostische Verwertbarkeit und die Spezifität der Hautimpfungen nut Trichophytnem. *München. med. Wchnschr.*, 68: 1288, 1921.

44. Jausion, H., and Sohler, R.: Vaccine Therapy of Mycotic Infections.—Claso-vaccine and toxic filtrate. Bull. Soc. franc. de dermat. et syph., 36:442, 1929.

Same authors and subject: Results in Dermatomycoses and Postmycotic Eczemas. Ibid, 36:447, 1929.

45. Rivalier, E.: Experimental Investigations on Allergy and Immunity in Trichophyton Infections. Ann. de dermat. et syph., 10:618, June, 1929.

46. Eugwer: Ueber Antikutine im Serum Trichophytiekranker. Berl. klin. Wehnschr., 58:803, 1921.

47. Weidman, F. D., and Chambers, S. O.: A Fungistatic Strain of *Bacillus subtilis* Isolated from Normal Toes. Arch. Dermat. & Syph., 18:569.

48. Kesten, Beatrice M.: (1929) The Porto Rico Journal of Public Health and Tropical Medicine, 5:185.

49. Bloch, Bruno: See reference 23.

50. Lombardo, C.: (1911) Gior. ital. d. mal. ven., 52:70.

51. Sabrazès, J.: (1893) Ann. de dermat. et syph., 4:340.

52. Bukowsky, J.: (1900) Arch. f. dermat. u. syph., 51:365.

53. Saeves, I.: See reference 25.

54. Kogaj, F.: See reference 28.

55. Fried, M. S., and Segal, M. B.: (1929) Arch. Dermat. & Syph., 19:98.

56. Scott, E. L., and McKinley, E. B.: (1930) In press.

CLINICAL NOTES

ELEVEN CASES OF CEREBROSPINAL FEVER

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The cases that follow were admitted to the naval hospital, San Diego, Calif., between October, 1929, and May, 1930. They illustrate a variety of clinical pictures seen in this disease.

CASE I—E. R. B.—Apprentice seaman; age, 17 years; admitted from United States naval training station, San Diego, Calif., October 29, 1929.

Duration of service when taken ill, 14 days. Received two injections typhoid vaccine prior to admission.

Signs and symptoms on admission.—Temperature, 100°; pulse, 100; respiration, 25. Delirious; violently resisted any attempts to examine him. Petechial rash over body; Kernig's sign present. Neck very stiff. Babinski sign, positive. Tache cerebrale present. Eyes, injected. Leucocytes, 35,000. Cerebrospinal fluid, turbid and under increased pressure; cell count, 12,000 per c. m. m. Gram-negative intracellular and extracellular diplococci present.

One hundred cubic centimeters antimeningococcic serum given intravenously and 15 c. c. intraspinally as soon as diagnosis was made. During the second day, 100 c. c. of antimeningococcic serum were given intravenously and 56 c. c. intraspinally. During the next 12 days, 395 c. c. of serum were given intraspinally. The serum was given in larger doses and over a longer period than usual as the meningococci persisted in the cerebrospinal fluid for 11 days. During convalescence, he developed right orchitis and epididymitis. He was returned to duty, well, on March 4, 1930, having been 126 days on the sick list.

CASE II—G. J. B.—Seaman, second class; age, 23 years; admitted from United States naval air station, San Diego, Calif., December 6, 1929.

Duration of service when taken ill, 127 days. Received three injections typhoid vaccine during first month of service.

Signs and symptoms on admission.—Temperature, 102°; pulse, 86; respiration, 20. Headache; backache; photophobia. Not delirious. Neck stiff; Kernig's sign positive; Babinski's positive. Tache cerebrale very marked. Leucocytes, 27,200. Cerebrospinal fluid, turbid, and under increased pressure; cell count, 5,450 per c. m. m. Intracellular and extracellular Gram-negative diplococci present in sediment.

Ninety cubic centimeters antimeningococcic serum were given intravenously and 30 c. c. given intraspinally when the diagnosis was established. During the next day, 90 c. c. of serum were given intravenously and 20 c. c. intraspinally. During the next three days, 70 c. c. of serum were given intraspinally. He made an uninterrupted recovery and returned to duty January 24, 1930, having been 49 days on the sick list.

CASE III.—A. D. W.—Shipfitter, first class; age, 32 years; admitted from U. S. S. *Medusa*, December 22, 1929.

Duration of service when taken ill, two years. Received typhoid vaccine during first month of service.

Signs and symptoms on admission.—Temperature, 101.8°; pulse, 120; respiration, 24. Not delirious. Petechial rash over body. Neck stiff; Kernig's sign, positive. Vomited. Tache cerebrale, positive. Leucocytes, 17,600. Cerebrospinal fluid, very cloudy; not under much pressure (28 drops per minute at first); cell count, 32,500 per c. m. m. Gram-negative intracellular diplococci found in sediment.

Fifteen cubic centimeters antimeningococcic serum were given intravenously and 15 c. c. intraspinally as soon as the diagnosis was established. During the next two days, 45 c. c. of serum were given intraspinally. On the third day after admission the cell count of the cerebrospinal fluid was 425, and the meningococci were no longer found. A week after admission he claimed not to be ill, except for stiffness of the neck and shoulders. He returned to duty, well, January 24, 1930, having been only 33 days on the sick list.

CASE IV.—U. H. F.—Apprentice seaman; age, 17 years; admitted from United States naval training station, December 24, 1929.

Duration of service when taken ill, 32 days. Had recently finished three injections of typhoid vaccine.

Signs and symptoms on admission.—Temperature, 101.4°; pulse, 104; respiration, 24. Comatose; neck stiff; Kernig's sign, positive. Tache cerebrale present. Leucocytes, 20,600. Cerebrospinal fluid, turbid, under considerable pressure; cell count, 17,000 per c. m. m.; smear from sediment, positive for intracellular and extracellular Gram-negative diplococci.

Thirty-five antimeningococcic serum given intravenously and 15 c. c. given intraspinally as soon as the diagnosis was established. During the second day, 90 c. c. serum given intravenously and 30 intraspinally. During the next five days, 115 c. c. of serum were given intraspinally. As a complication, he had partial deafness of the left ear for one month. He was discharged to duty, well, on April 8, 1930, having been 105 days on the sick list.

CASE V.—D. C. B.—Apprentice seaman; age, 17 years; admitted from United States naval training station, San Diego, Calif., January 24, 1930.

Duration of service when taken ill, 15 days. He had received two injections of typhoid vaccine prior to admission.

Signs and symptoms on admission.—Temperature, 99.4°; pulse, 84; respiration, 20. Neck stiff and head retracted; comatose; incontinence of urine and feces. Tache cerebrale present. Kernig's sign positive; Brudzinski's sign positive; knee jerks abolished. Leucocytes, 41,900. Cerebrospinal fluid, cloudy, under increased pressure; cell count, 10,800 per c. m. m.; smear from sediment positive for intracellular and extracellular Gram-negative diplococci.

He received 60 c. c. antimeningococcic serum intravenously and 30 c. c. intraspinally as soon as the diagnosis was established. Later in the day he received 18 c. c. of serum intraspinally. On the second day he received 60 c. c. serum intraspinally, and on the third day 60 c. c. by the same route. On the second day he regained consciousness and was slightly improved. On the third day he was cyanotic and delirious. The temperature rose to 103°, the pulse to 130, and the respiration to 26. Cheyne-Stokes' respiration was present. He died on January 27, 1930, having been in the hospital 67 hours.

Autopsy findings.—The body presented for examination was that of a young, well-developed, adult male about 18 years of age. The pupils were equal. There was a frothy discharge from the left nostril. There was a scar of a recent vaccination (cowpox) on the left upper arm.

Chest.—Heart: Pericardial sac contained about 100 c. c. of a purulent fluid. Heart was normal in size. The valves were all normal. There was some dilatation of the auriculoventricular ring. It admitted four fingers readily.

The lungs were both congested. There were no adhesions, and they both floated.

The liver was somewhat enlarged, weighing approximately 2,500 gm. It had an irregular, mottled appearance. On section it presented the picture of acute congestion.

The spleen was normal in size and rather firm.

Stomach and intestines were normal.

Kidneys normal in size, capsules stripped easily. They appeared acutely congested. Pancreas normal.

Brain.—Presented numerous petechial hemorrhages throughout. The brain stem was covered by a sero-purulent exudate.

The ventricles contained cloudy fluid and the choroid plexus was covered with pus.

Autopsy findings.—(1) Cerebrospinal fever (meningitis); (2) beginning pneumonia; (3) acute heart failure (dilatation).

CASE VI—D. O. C.—Apprentice seaman; age, 18 years; admitted from United States naval training station, San Diego, Calif., at 12:15 a. m., April 9, 1930. Duration of service when taken ill, 22 days. He completed the series of three typhoid vaccine injections five days before admission.

Signs and symptoms on admission.—Temperature, 105; pulse, 130; respiration, 30. Petechial rash over body. Stuporous but could be aroused. Involuntary passage of urine and feces. Kernig's sign not present. No stiffness of neck; vomited; dullness on percussion of lower left chest. Leucocytes, 31,800. Spinal puncture not done. Extensive purpuric rash present before death. Died at 4:30 a. m., 4 hours and 15 minutes after admission.

Autopsy findings.—The body was that of a well-developed, well-nourished young male of about 19 years apparent age. The body had been embalmed. The skin of the face and entire body was spotted with a hemorrhagic rash, and between the petechial spots was a dark purplish cyanotic appearance giving the body almost a black appearance. This was observed before embalming. After injection with embalming fluid the purplish cyanosis was largely washed out, but the hemorrhagic spots were not changed.

Chest: Pleural fluid normal in amount and color.

Lungs: There were several petechiæ scattered over the surface of the lungs. On sections the lungs were seen to be acutely congested throughout. No areas of consolidation noted.

Heart: Two subpericardial petechiæ noted. Myocardium normal. Endocardium and valves normal.

Abdomen: A few petechiæ beneath the parietal peritoneum.

Liver: Riddled with small hemorrhages which in some areas had coalesced to form spots as large as $\frac{1}{2}$ cm. Parenchyma soft.

Kidney: Acutely congested.

Spleen: Acutely congested. Several hemorrhagic spots noted beneath the capsule.

Brain: Congested and wet. No exudate.

Spinal cord: Some congestion; otherwise negative.

Note: Cerebrospinal fluid obtained at autopsy by cisternal puncture gave a cell count of 600. No organisms found. Culture made.

Smear from liver showed Gram-negative diplococci, morphologically meningococci. No blood cultures taken ante mortem.

Pathological diagnosis.—Septicemia (meningococci).

CASE VII—*F. F. R.*—Apprentice seaman; age, 17 years; admitted from U. S. S. *Melvin* on February 25, 1930. Duration of service when taken ill, 106 days. Received three injections of typhoid vaccine during first month of enlistment.

Signs and symptoms on admission.—Temperature, 103; pulse, 110; respiration, 24. He had signs of catarrhal fever which began three days earlier. Vomited; neck stiff and head retracted; face flushed. Tache cerebrale present. Kernig's sign positive. Leucocytes, 22,300. Cerebrospinal fluid: Cloudy, under increased pressure; cell count, 8,600; no bacteria found in smear of sediment; culture showed meningococci in 48 hours. During the first day, 90 c. c. of antimeningococcic serum were given intravenously and 15 c. c. intraspinally. During the next five days, 210 c. c. serum were given intraspinally. He had no complications and made an uninterrupted recovery. Returned to duty, well, on May 9, 1930, having been 73 days on the sick list.

CASE VIII—*R. S. C.*—Apprentice seaman; age, 17 years; admitted from United States naval training station, San Diego, Calif., on March 14, 1930. Duration of service when taken ill, 70 days. Received three injections of typhoid vaccine during first month of enlistment. He was admitted with acute otitis, media, left ear. The drum membrane was incised and a drop of pus escaped.

Signs and symptoms on the third day after admission were as follows: Temperature, 104; pulse, 120; respiration, 20. Chill; photophobia; neck not stiff. Kernig's sign negative. On the fourth day, Kernig's sign was positive and the neck was stiff. The cerebrospinal fluid examination was as follows: Cloudy, under increased pressure; cell count, 23,250 per cm.; Gram-negative intra and extra cellular diplococci found in the smear from the sediment. Later a culture of meningococci was made from the cerebrospinal fluid. Ninety cubic-centimeters antimeningococcic serum were given intravenously and 15 c. c. intraspinally as soon as the diagnosis was established. During the next six days, 200 c. c. of serum were given intraspinally. The hearing of the left ear improved to 15/15. He returned to duty, well, on May 13, 1930, having been 60 days on the sick list.

CASE IX—*C. R. W.*—Seaman, second class; age, 22 years; admitted from United States naval training station on March 14, 1930. Duration of service when taken ill, 10 months. Received three injections typhoid vaccine during first month of enlistment.

Signs and symptoms on admission.—Temperature, 102.4°; pulse, 108; respiration, 27. Delirious; slight petechial rash over body; neck stiff and head retracted. Kernig's sign positive. Tache cerebrale present. Leucocytes, 19,600. Cerebrospinal fluid: Turbid, under increased pressure; cell count, 16,875 per c. m. m.; intracellular Gram-negative diplococci present in smear from sediment. Later a culture from the cerebrospinal fluid was positive for meningococci. During the first day, 15 c. c. of antimeningococcic serum were given intravenously, 15 c. c. intraspinally, and 30 c. c. intramuscularly. During the next four days, 125 c. c. of serum were given intraspinally and 60 c. c. intramuscularly. He had no complications. He made an uninterrupted recovery and returned to duty June 10, 1930, having been on the sick list 88 days.

CASE X.—*J. R. H.*—Apprentice seaman; age, 17 years; admitted from United States naval training station, San Diego, Calif., on April 12, 1930. Duration of service when taken ill, 25 days. Received three injections typhoid vaccine, the last injection being given seven days before admission.

Signs and symptoms on admission.—Temperature, 101.8°; pulse, 112; respiration, 22. Headache; petechial rash present but not very pronounced; vomited;

vertigo. Kernig's sign positive; neck stiff; not delirious but sleepy. When aroused, answered questions in a rational manner. Cerebrospinal fluid: Pressure increased; slight cloudiness; cell count, 940 per c.m.m.; no microorganisms found. The attempted culture from the cerebrospinal fluid did not show a growth. A diagnosis of cerebrospinal fever was made from the above signs and symptoms. Twenty cubic centimeters antimeningococcic serum were given intraspinally at once and 75 c. c. given intravenously the following morning. During the next three days, 110 c. c. serum were given intraspinally. Five days after the first serum was given he had a severe serum rash. This rash was only partially relieved by the usual doses of atropine and adrenalin; when the doses of atropine and adrenalin were increased, he became delirious. On discontinuing the atropine and adrenalin, the delirium ceased. The rash completely disappeared in six days. Calamine lotion allayed the rash to some extent. He had no other complications, and completely recovered. While the meningococcus was not found in the blood or cerebrospinal fluid in this case, the signs and symptoms were unmistakably those of meningitis and the probable diagnosis was cerebrospinal fever.

CASE XI.—L. A. D.—Apprentice seaman; age, 17 years; admitted from United States naval training station, San Diego, Calif., on May 12, 1930. Duration of service when taken ill, 11 days. Received one dose of typhoid vaccine two days before admission.

Signs and symptoms on admission.—Temperature, 104.4°; pulse, 120; respiration, 22. Diffuse petechial rash scattered over body. He was conscious but dull. Laid in bed with eyes closed. Answered questions usually in monosyllables but correctly. Vomited; complained of severe pain in ankles and knees. Fauces injected. Pupils equal, reacted to light and accommodation. Kernig's sign negative; neck not stiff. Leucocytes, 18,500. Cerebrospinal fluid: Not under increased pressure, clear, 4 cells per c.m.m. All cells found were lymphocytes. Sugar, 88 mgs. per 100 c. c. fluid. Five hours after admission there was a purpuric rash over whole body. The largest purpuric areas were on the hands, elbows, knees, and ankles. The pulse at the wrist, five hours after admission, could not be counted accurately because of its weakness and rapidity. The probable diagnosis at this time was meningococcic septicemia. One hundred cubic centimeters of antimeningococcic serum were given intravenously.

The next morning a second spinal puncture was done. The fluid was under increased pressure, was cloudy, and contained 17,100 cells per c. m. m. Its sediment showed Gram-negative diplococci. A culture from the cerebrospinal fluid later was found to be meningococci. He was again given 100 c. c. of serum intravenously. Twenty-one cubic centimeters of serum were given intraspinally and in the evening the intraspinal dose was repeated. During the second day, he was very restless, talked almost continuously and was usually incoherent. During the next five days, 147 c. c. of serum were given intraspinally. Five days after admission, it was noticed that he had iritis and keratitis of the left eye. Twenty-five days later he had made a good recovery as far as his general health was concerned. The report from the ophthalmologist stated that the prognosis for useful vision of the left eye was not good.

It was necessary to give an anesthetic (nitrous oxide and oxygen) to six of the patients when the spinal punctures were made. These men were delirious and could not appreciate the necessity of lying quietly as an aid to the operator, nor was it desirable to use physical restraint or unnecessarily increase their struggles. All of these

patients, except case No. 6, who died four hours after admission, were given morphine hypodermically throughout the acute stage of the disease.

All of the patients, except case No. 6, had opisthotonos. This sign was usually one of the last to leave. A serum reaction usually appeared on the sixth, seventh, or eighth day of the disease. This rash was controlled without difficulty, except in case No. 10. All of the patients who lived were isolated until three cultures from the nose proved negative for the meningococcus.

COMMENT

The antimeningococcic serum used at this hospital is potent and effectual in the treatment of the types of cerebrospinal fever encountered.

Of the 11 cases, 2 have died, 7 have returned to duty, 1 will return to duty when his leave of absence expires, and 1 has recovered except for partial loss of vision in one eye.

Case No. 6 died four and one-quarter hours after admission. The diagnosis was made post-mortem. No serum was administered.

Case No. 5 died 67 hours after admission. We are unable to account for his death. It may be that he did not receive intravenous serum in sufficient amount or early enough.

Case No. 11 was given 100 c. c. serum before the diagnosis was definitely established. He did not have meningeal symptoms; the cerebrospinal fluid was not under increased pressure and the cells were not increased. The serum was given because the most probable diagnosis was meningococcic septicemia with an intense purpuric rash. Case No. 6, who presented similar symptoms, died very promptly without receiving serum.

A culture made from the cerebrospinal fluid of case No. 7 was agglutinated in the following dilutions:

Antimeningococcic serum-----	"Le"__	1-512
Do-----	"M"__	1-512
Do-----	"Li"__	1-1,024

A culture made from the cerebrospinal fluid of case No. 11 was agglutinated in the following dilutions:

Antimeningococcic serum-----	"Le"__	1-512
Do-----	"M"__	1-1,024

The necessity for giving the serum by way of the cisterna magna was not apparent in these cases. Cerebrospinal fluid was readily drained from the subarachnoid space and partially replaced by serum by means of lumbar puncture. The intraspinal puncture in the third lumbar space is considered the safer method for introducing serum. The needle did not become occluded, and dry punctures are

unlikely if the needle is properly inserted. It is believed that the constant changing of personnel at this hospital would not justify the adoption of the cisternal puncture in preference to the lumbar puncture as a routine measure.

CONCLUSIONS

While it is realized that positive conclusions as to the treatment of cerebrospinal fever from so few cases are not warranted, we believe that certain conclusions are justifiable.

Early in the disease large doses of antimeningococcic serum should be administered intravenously; 90 or 100 c. c. of serum should be given intravenously as soon as possible and an equal quantity given on the second day. Intraspinally injections should be given as soon as the diagnosis is established. Twenty to thirty cubic centimeters of the serum should be given intraspinally twice a day during the acute stage of the disease. The intraspinal injections should continue as long as meningococci are found in the cerebrospinal fluid. The absence of meningococci in the cerebrospinal fluid and the improvement in symptoms should be the guides in determining when to cease serum treatment. Because the patient has 2,000 or 3,000 cells in the cerebrospinal fluid or because the cells are increasing are not sufficient reasons for continuing the administration of serum, as the serum itself may cause an irritation of the meninges and therefore an increase in the number of cells.

With reference to the intravenous injection of antimeningococcic serum, the following is quoted from "Acute infectious diseases," Schamberg and Kolmer, 1928, pages 854 and 855:

Herrick has reported particularly good results from the treatment by intravenous injections of serum in severe adult cases, the patient often coming out of coma with rapid recession of the rash and symptoms. The mortality was reduced from 64 to 19 per cent. Out of Herrick's 265 cases, 64, or 28 per cent, proved fatal, but out of 137 cases given ordinary intraspinal injections and less than 45 c. c. of serum intravenously, 47, or 34 per cent, proved fatal, whereas out of 128 cases treated intraspinally with small doses and intravenously with large doses of serum, 19, or 15 per cent, proved fatal.

It is well known that an injection of typhoid vaccine will occasionally cause fever for several hours or days. Six of the patients developed cerebrospinal fever shortly after typhoid vaccination. In these cases it is reasonable to conclude that typhoid vaccination was one of the several contributory factors predisposing to the development of cerebrospinal fever.

**A CASE OF ANHEMATOPOIESIS FOLLOWING NEOARSPHENAMINE
THERAPY IN THE TREATMENT OF SYPHILIS**

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The following case, occurring in a man aged 22, after the administration of the twelfth dose of arsenamine for the treatment of syphilis, is reported because of its unusual features and the rapidity of its course. In reviewing the literature on the subject we find that up to February, 1930, there have been but 40 cases reported, of which 22 died and 18 recovered, giving a mortality of about 56 per cent.

CASE HISTORY

Chief complaint.—Purple spots on feet.

History of present illness.—The patient was given the twelfth injection of neosalvarsan on February 27, 1930. He stated that the day following the injection, he felt an itching over the lumbar region; that on the next day, he noted purple spots on his feet, and that over other areas he bruised easily. He had noted no other signs, nor had he experienced any reactions after previous injections of neosalvarsan. Mercury inunctions had been given concurrently.

Family history.—Mother and father living and well. One brother and one sister living and well. No history of tuberculosis, cancer, or hemorrhagic diatheses in family.

Past history.—The patient has had the usual diseases of childhood without sequelæ; no diphtheria or scarlet fever. Except for occasional colds, he has always been well. The luetic infection was diagnosed November 1, 1929, by dark-field examination. Patient received eight neosalvarsan injections and a course of mercury ending December 27, 1929. The Kahn test was negative January 18, 1930. A second course of neosalvarsan was begun on February 6, 1930, when the patient received 0.3 gram. Thereafter he was given 0.6 gram once weekly for three doses, and following the last of these the present illness began.

Physical examination.—The patient was a well-nourished young white male, cooperative and intelligent.

Head and neck.—Hair and scalp, negative; ears, normal; pupils equal, regular, and react to light and accommodation. There is a small hemorrhage into the left sclera. Nose, mouth, and throat presented no abnormalities. Some post-cervical adenopathy was present. The thyroid was not palpable.

Heart, lungs, and abdomen.—Normal.

Genitalia.—Normal except for penile scar of recent chancre.

Arms, legs, and reflexes.—Negative.

Skin.—Numerous small and diffused patches of purpura were seen on dorsum of both feet; other purpuric areas ranging in size from pin point to 1 centimeter in diameter were found on the legs, thighs, abdomen, chest, and arms.

Laboratory findings.—Urinalysis was normal, chemically and microscopically. Blood: Red blood count, 4,000,000; hemoglobin, 90 per cent; white blood count, 5350; coagulation time, 4 minutes; bleeding time, 15 minutes; platelet count, unsatisfactory; fragility test showed complete hemolysis at 0.32 per cent sodium chloride and partial hemolysis beginning at 0.44 per cent.

Treatment and progress notes.—March 1, 1930: The patient was ordered to bed and sodium thiosulphate, 1 gram, was given intravenously.

March 2, 1930: Patient noted bloody urine and epistaxis. The urine was bright red, loaded with the cellular elements of blood, and was positive for albumin. Red blood count, 3,472,000; hemoglobin, 90 per cent; white blood count, 3,350; polymorphonuclears, 36 per cent; lymphocytes, 64 per cent. Feces were negative for blood. He was given 500 grams of liver daily by mouth and 1 gram of calcium lactate thrice daily after meals.

March 6, 1930: Red blood count was 3,184,000; white blood count, 2,250; polymorphonuclears, 15 per cent; and lymphocytes, 85 per cent. Urine remained bright red; yet the patient remained comfortable, with temperature, pulse, and respiration normal.

March 7, 1930: Urine was still dark red; specific gravity 1.024. There was a heavy trace of albumin; negative for sugar. There were numerous blood cells.

March 8, 1930: The urine remained unchanged.

March 9, 1930: Red-blood count, 2,420,000; hemoglobin, 50 per cent; white-blood count, 3,400; polymorphonuclears, 19; lymphocytes, 76; mononuclears, 2; eosinophiles, 3. Urine was dark red and positive for albumin and red cells.

March 10, 1930: Red-blood count, 2,042,000; hemoglobin, 48; white-blood count, 1,450; polymorphonuclear, 1; lymphocytes, 98; large mononuclear, 1; platelet count, 14,200; bleeding time, 11 minutes; coagulation, 5½ minutes; no reticulocytes noted. The patient's blood was typed for transfusion, and on March 10 he was given 350 c. c. of whole blood, with no immediate reaction. The direct whole-blood method was used.

March 11, 1930: The temperature rose to 40.2 C, but the patient was fairly comfortable, and physical examination revealed nothing to account for this rise except reaction from transfusion. Blood count this date showed red-blood count, 2,608,000; hemoglobin, 55; white-blood count, 1,400; polymorphonuclear, 5; lymphocytes, 93; large mononuclears, 2; platelets, 56, 640, and no reticulocytes. The tourniquet test was negative. The urine continued to show a considerable amount of blood; specific gravity, 1.026; an acid reaction; positive for albumin and negative for sugar; many red-blood cells and few white-blood cells. Occasional granular casts.

March 12, 1930: The temperature remained 40.0 C. The patient vomited in the afternoon after taking food and subjectively did not feel so well as before. He complained of slight soreness in his throat, and blood and throat cultures were made. Blood count this date: Red-blood count, 2,360,000; hemoglobin, 50; white-blood count, 800; no reticulocytes. A differential count was not possible owing to the scarcity of white cells, but all the cells seen were lymphocytes. The urine showed less blood.

March 13: The patient had a profuse nose bleed, lasting about one hour, and the nose was packed with tape moistened with adrenalin. Another transfusion of 350 c. c. of whole blood was immediately given. The temperature was 40.8 C.; pulse, 120; respiration, 24. The chest was clear. The spleen was not palpable. Red-blood count, 2,810,000; hemoglobin, 56; white-blood count, 1,950; one polymorphonuclear cell was seen in the stained smear. A complete differential count could not be made, owing to the scarcity of white-blood cells. There were no reticulocytes. The urine was yellow and apparently contained no blood but was turbid and had much sediment. Specific gravity, 1.028; alkaline in reaction; negative for albumin and sugar; no red-blood cells; a few white-blood cells; and no casts found.

March 14: Lungs showed no sign of frank consolidation. Breath sounds were harsh over right middle lobe anteriorly. Röntgenogram of chest showed the hilum shadow increased, with calcification on both sides. Markings ad-

jacent to hilum in right middle and lower areas were thickened. The fever continued high, reaching 41.2 C.; pulse, 120; respiration, 26. The throat was still inflamed. Another transfusion of 400 c. c. of whole blood was given. The urine was amber and cloudy; specific gravity, 1.020; positive for albumin, negative for sugar; a few white blood cells and one hyaline cast and no red blood cells. Blood: red blood count, 4,328,000; hemoglobin, 73; white blood count, 850; no differential count was possible. No reticulocytes were found. There had been apparently no further bleeding.

March 15: The patient developed a profuse maculo papular rash which disappeared on pressure. Temperature continued high at 41.0 C. At 4. m. respirations had increased to 40. At 6 p. m. pulse was almost imperceptible; there was profuse perspiration; the heart was enlarged to the left; sounds were clear and of fair muscular quality; the lungs showed no frank consolidation. At 11 p. m. respiration 46, became very rapid and labored. Heart sounds were weak and not clearly heard. The limbs were congested with blood. The finger tips were cyanotic, the pupils were dilated, the left more marked than the right. There was rigidity of the neck. The pulse was not perceptible at the wrist and the patient was unconscious. Rectal temperature was 41.8 C. There was a regurgitation of about 200 c. c. of dark fluid, and death occurred at 11.30 p. m.

AUTOPSY FINDINGS

Some red mottling of skin.

Abdominal cavity.—Hemorrhages retroperitoneally, about colon and right kidney.

Pleural cavity.—Twenty-five cubic centimeters blood tinged fluid in each cavity. Some fibrous pleural adhesions on left side.

Pericardial cavity.—Seventy-five cubic centimeters bloody fluid.

Heart.—Very flabby. Epicardial hemorrhages. Hemolytic discoloration of endocardium. Hemorrhages in myocardium.

Lungs.—Edematous; dark red; consistency somewhat increased but no consolidation.

Spleen.—Two hundred and fifty grams. Enlarged and very soft.

Liver.—Twenty-one grams; much enlarged; very soft; anterior section swollen; lobules with architecture poorly visible, pale pink and reddish brown.

Kidneys.—Two hundred and forty grams each; much swollen and soft; show hemorrhages. Right kidney, pelvis, and ureter show extensive hemorrhage.

Urinary bladder.—Few petechial hemorrhages.

Intestines.—Mucosa shows few petechial hemorrhages.

Aorta.—For yellow plaques. These also seen in coronary arteries.

Retroperitoneal lymph nodes.—Slightly enlarged and pigmented, bluish black in color.

Femur bone marrow.—Light reddish pink.

Vertebra and rib bone marrow.—Very pale and grayish pink.

Bronchial lymph nodes.—Enlarged somewhat. One shows area of caseation.

Thymus.—Weight, 20 grams.

Rib and vertebral bone marrow.—Very little blood formation is going on and the bone marrow consists largely of adipose tissue and homogeneous or finely granular, pink staining material. Shadows of cells are seen in some of the pink staining areas, and scattered diffusely but sparsely throughout there are found two kinds of cells in about equal numbers. One of these cells is small and has a very scanty, almost invisible cytoplasm and a round very dark-blue staining nucleus. The other cell is larger, is round, or

roughly oval, has an abundant bluish pink staining cytoplasm, and a small or moderate-sized round nucleus which stains dark blue, is often coarsely granular and eccentrically placed. These are taken to be normoblasts. In the rib the number of blood-forming cells is even less than in the vertebra. There are no megalokaryocytes and no myelocytes. Some masses of cocci are present. Oxidase stain of formalin, fixed vertebra scrapings is negative. Control is positive.

Femur bone marrow.—Consists largely of adipose tissue with some homogeneous or finely granular, pink staining areas seen here and there. There are a few small islands of cells similar to those seen in the rib and vertebra sections with the small round cell predominating. No megalokaryocytes or cells with granular cytoplasm are found. There are some large cells which contain greenish brown, rather large, irregular masses of pigment.

Anatomical diagnosis.—Aplasia and gelatinous degeneration of bone marrow. Hemorrhages in retroperitoneal tissue, kidneys, lungs, heart, mucosæ of gingivæ, urinary bladder, colon, and stomach. Marked degeneration of kidneys, liver, and myocardium. Splenomegaly with hyperplasia and congestion. Marked phagocytosis of blood in axillary, mesenteric, retroperitoneal, and tracheobronchial lymph nodes. Perivascular accumulations of leukocytes in skin. Edema of lungs. Hydropericardium. Early arteriosclerosis with marked arteriosclerosis of coronary arteries. Fibrous pleural adhesions (left). Tuberculous lymphadenitis of bronchial lymph node. Chronic tonsillitis.

COMMENT

As this type of arsphenamine poisoning is rare, a brief review of the etiology and pathology of the entity and a résumé of the cases reported to date are included here.

Etiology.—The majority of the cases are reported as neoarsphenamine and sulpharsphenamine poisoning, but because of their similarity to reported cases of benzene poisoning it seems probable that the benzol nucleus in the arsenical preparations is the responsible agent. Arsenical poisonings are accompanied by an eosinophilia and not a leucopenia with lymphocytosis, and cases of marked arsenical reactions show no effect on blood platelets or red blood cells. As the majority of these cases occur after several injections of arsphenamine, an accumulative toxicity may well be suspected.

Pathology.—Aplasia of the bone marrow is the primary pathology. A total death of the bone marrow accounts for the fatal cases. Those that recover have only hypoplasia or partial loss of bone-marrow function. The loss of platelets accounts for the purpuric manifestations, the prolonged bleeding time, and the poor retraction of the clot; the death of the myeloblasts accounts for the gradual leukopenia and total loss of polymorphonuclear cells, while the destruction of the nucleated reds accounts for the gradual anemia, the absence of reticulated reds, and other embryonic forms.

The hemorrhages in the skin, mucous membranes and serous membranes, and the hematuria and epistaxis are a result of the loss of platelets. The pallor and the concomitant signs of anemia that

develop are due to the loss of the red cells. Death is caused by any low-grade terminal infection even though it be caused by a saprophyte or usually nonpathogenic organism. The lungs in these cases will show an edematous reaction partly as a result of the anemia and partly because the cellular elements of the blood are lacking.

Symptoms and signs.—Hemorrhage, as manifested by purpura and purpuric manifestations, is the predominant symptom. It usually appears in the skin and is accompanied by itching; hematuria, epistaxis, hemorrhages from the gums and oral mucous membranes may also occur and if these are severe, signs of anemia, such as pallor, weakness, and slight dyspnea occur. Later, there may or may not be febrile manifestations. Depending on the severity of the case, these symptoms may be aggravated and others will appear as a result of this same pathological condition. Stomatitis, scaling of the skin, and headache are also present.

Diagnosis.—The appearance of purpura, or of hemorrhage from no other explainable cause, should make one suspect this condition. Scurvy, secondary hemorrhage, purpura, and severe anemias from other causes must be considered and eliminated. During the course of arspenamine treatment the appearance of purpura hemorrhagica, aplastic anemia, and agranulocytosis points to hemopoietic poisoning of bone marrow.

Leukemias are ruled out by absence of splenic or lymph gland enlargement, absence of bone soreness, and by the blood count, but an aleukemic phase or lymphatic leukemia would confuse the differential diagnosis.

Laboratory findings.—Consist principally of (a) low platelet count (b) a lowered red blood count though the hemoglobin may remain high; (c) leucopenia with a decrease of the polymorphonuclears even to 0 in fatal cases. More important is the fact that the myeloblasts and reticulated reds are not seen, and there are no signs of embryonic forms being sent out from the bone marrow.

The fragility test is negative, clotting time is normal, but bleeding time is markedly prolonged and clot retraction is poor. The urine or stool may show evidence of hemorrhage and when it does it is apt to be extremely marked.

Prognosis.—This is indicated quite reliably in the blood picture. A progressive decrease in all the elements of the blood except the lymphocytes foreshadows a grave prognosis. If young polymorphonuclears are seen and reticulated reds can be found the prognosis is better, but if the stained films show signs of an absolute anhematopoiesis the prognosis becomes hopeless.

Prophylaxis.—Apparently there is none; cases are rare, and a single case may occur among a group of individuals who were given the drug from the same lot, and even from the same tube. If an

accumulative effect is suspected a routine blood count before every injection of an arsenical should be made, and if a leucopenia with lowered polymorphonuclear count appears, it should be considered a contraindication to injection of an arsenical. Any case under treatment developing a purpura or a hemorrhage from unexplained causes should not be treated with arsenical compounds unless further study of the case proves something besides the arsenical as the etiologic agent.

Treatment.—1. Sodium thiosulphate. This has no direct value but will neutralize any added toxicity caused by arsenic and should be given early and in full doses.

2. Calcium lactate, thromboplastin, and other coagulative measures are indicated especially in cases with severe purpuric manifestations. Iron or the more recently advocated combinations of iron with small amounts of other metals might be given to combat the anemia.

3. Liver, either fresh or in extract, or the newer ventriculin preparations should be given, especially if there is any evidence that bone marrow is not entirely lost.

4. Blood transfusions should be given early to combat the anemia. Whole blood should be used and not the indirect citrate method.

SUMMARY

1. The patient began his first course of neoarsphenamine treatment on November 1 and finished on December 27, 1929, receiving eight (8) injections at weekly intervals. He began his second course February 6, after a rest period of six weeks, and had received four injections, the last on February 27. The first symptoms appeared on March 2.

2. Cases of arsphenamine poisoning manifesting symptoms similar to those in our case are rare, and are analogous to the symptoms and blood changes seen in benzene poisoning. It seems reasonable to assume that the benzol ring in the arsphenamine, rather than the arsenic, is responsible for the condition.

Table I will afford the reader a ready reference to the cases of this type of arsphenamine poisoning thus far reported in the literature. It is significant that all the fatal cases in this series showed a total white blood count of less than 2,000, practically no polymorphonuclears, and a very high percentage of lymphocytes.

Table II shows the main clinical features, blood picture, and necroscopy findings in a series of cases of benzene poisoning found in the literature.

TABLE I

Num- ber of case	Drug	Doses	Hemor- rhages	Anemia	White blood count lowest	Polys	Platelets	Fever	Trans- fusion	Result	Post-mortem observations	Refer- ence No.
1	Neorsphen	8	Yes.	Severe	4,000	Low.		Moderate.		Recovered.	Incomplete.	4
2	do.	10	Yes.	Severe	500	0	175,000	High.		Died.		5
3	Arsphenamine	7	Yes.	Severe	700	7		High.	2	Died.		6
4	Sulpharsphen	2	Yes.	Moderate	1,600	30	(¹)	do.		Recovered.		7
5	Arsphenamine	26	Yes.	Severe	600	12	10,000	Moderate.	2	Died.	Hemorrhages, aplastic bone marrow	8
6	do.	2	Yes.	do.	2,700	46	48,000	High.		do.	do.	9
7	Silver arsphen.	10	Yes.	Moderate	1,200	Low.	(¹)	Moderate.		Recovered.		10
8	Arsenical drug	1	Yes.	Severe	520	6		do.		Died.		11
9	Neorsphen	6	Yes.	Moderate	4,600	30		do.		do.	Hemorrhages, aplastic bone marrow	12
10	do.	16	Yes.	Severe	8,500	34		Low		Recovered.		13
11	Arsphenamine	2	No.	None	3,800	10		Moderate.		do.		14
12	do.	5	No.	do.	2,800	0		High	1	Died.		15
13	do.	4	Yes.	Severe	600	$\frac{1}{2}$					Hemorrhages, aplastic bone marrow	16
14	do.	8	Yes.	Moderate								17
15	do.	2	Yes.	Moderate								18
16	Neorsphen	9	Yes.	Moderate	550	4	28,000	High	4	Died.	Hemorrhage, aplastic bone marrow	19
17	Arsphenamine	6										20
18	Neorsphen	10										21
19	Sulpharsphen	7										22
20	Tryparsamide	16										23
21	Sulpharsphen	3	Yes.	Moderate	4,300	60	80,000			Recovered.		24
22	Neorsphen	8	Yes.	Moderate	7,300	88	44,000	Low		Recovered.	Hemorrhages, bone marrow not ex- amined.	25
23	Sulpharsphen	29	Yes.	do.	1,000	51				Died.		26
24	do.	18	Yes.	Severe	1,200	55		High	2	do.		27
25	do.	12	Yes.	Severe						Recovered.		28
26	do.	24	Yes.									29
27	do.	9										30
28	Merbaphen	2 1/2	Yes.	Moderate	29,000	46	70,000	High		Died.	Hemorrhages, aplastic bone marrow	31
29	Colloidal silver, 5 per cent.	32										32
30	Silver											33
31	Arsphen	2										34
32	Merbaphen											35
33	Colloid											36
34	Silver, 12 per cent.	36	Yes.	Moderate	76,000		(¹)	Moderate.		Died.	Hemorrhages, aplastic bone marrow	37
35	Neorsphen	2										38
36	Sulpharsphen	1	No.	Slight	4,400	65	180,000	High		Recovered.		39
37	do.	4	No.	do.	136	0	(¹)	do.		Died.	Hemorrhage, pneumonia aplastic.	40

25	Nearsphen	16	Yes.	Moderate.	1,500	5	24,000	do.	0	do.	Hemorrhage in all organs.	20
26	do.	3	Yes.	3.27	4,400	1	182,000	Moderate.	0	Recovered.	do.	21
27	do.	(9)	Yes.	2.22	3,400	8	5,000	do.	0	do.	do.	22
28	do.	2	Yes.	3.9	10,000	(1)	0	High.	0	Died.	Hemorrhages.	23
29	do.	5	Yes.	1.25	400	0	(1)	do.	0	do.	Hemorrhages, aplasia (bone marrow)	24
30	do.	17	Yes.	3.0	5,200	43	4,500	do.	0	Recovered.	do.	25
31	do.	(7)	Yes.	1.28	1,200	41	(1)	do.	0	Died.	do.	
32	do.	(7)	Yes.	1.5	2,600	25	25,000	do.	0	Recovered.	Hemorrhage and aplasia of red blood count and white blood count elements.	26
33	do.	(7)	Yes.	0.6	4,500	20		Moderate.	2	Died.	do.	
34	do.	6	Yes.	0.56	2,800	12	89,600	High.		do.	Hemorrhages in all organs.	
35	do.	6	Yes.	3.9	1,000	0		Present.		do.	Later count showed 56 per cent polys and 6,500 white blood counts.	
36	do.	3	Yes.	3.3	5,250	0		do.		Recovered.	Probably lymphatic leukemia.	
37	do.	3	Yes.	0.9	60,000	0	270,000	do.		Died.	Later count showed 68 per cent polys and 6,300 white blood counts.	
38	do.	12	Yes.	4.5	4,100	30		do.		Recovered.	do.	
39	do.	6	Yes.	3.8	6,600	69		Yes.		do.	Later count showed 6,000 white blood counts.	
40	do.	10	Yes.	3.4	3,300	8		do.		do.	do.	

* Scarce.

† Not done.

‡ Several.

§ Very low.

TABLE II

Num-ber of case	Drug	Hemor-rhages	Red blood count lowest	White blood count lowest	Polys	Platelets	Fever	Trans-fusions	Results	Post-mortem observations	Refer-ence No.
1	Benzene.	Yes.	0.64	600	43				Died.	Hemorrhages in all viscera; aplasia of bone marrow.	27
2	do.	Yes.	1.15	140	16				do.	do.	
3	do.	Yes.	4.90	4,500	10	4,000			Recovered.	Later blood study showed complete recovery.	
4	do.	Yes.	.86	1,400		70,000	Yes.		Died.	Hemorrhages, aplasia of bone marrow.	28

These cases occurred in workers in tin-can factories. Others showed low total white blood count and decreased percentage of polymorphonuclear cells. Santesson (29) in 1897 reported 9 other cases of benzene poisoning with an identical clinical picture. Four died and necropsy showed hematopoietic insufficiency.

REFERENCES

1. Da Costa: *Modern Surgery*, 9th edition (415).
2. Hall, G. A. M.: Progress notes of case while in the Peiping Union Medical College Hospital, Peiping, China.
3. Garber, C. Z.: Autopsy reports of same.
4. Anwyl-Davies, T.: Purpura Hemorrhagica following the Therapeutic Administration of Neosalvarsan, *Brit. J. Dermat. and Syph.*, 1921, 33, 264.
5. Chattelier, M. L.: Fatal Purpura from Poisoning by Arsenobenzol, *Bull. Soc. franc. d. dermat. et syph.*, 1923, 30, 51.
6. Coombes, F. C.: Purpura Hemorrhagica following Sulpharsphenamin, *Arch. Dermat. and Syph.*, 1927, 15, 194.
7. Evans, F. A.: Observations on the Origin and Status of the So-called Transitional White Blood Cells, *Arch. Int. Med.*, 1916, 17, 1.
8. Feinberg, S. M.: Aplastic Anemia following Neoarsphenamin, *J. Am. Med. Assn.*, 1922, 78, 888.
9. Gorke, H.: Development of Aplastic Anemia after Salvarsan, *Munchen. med. Wehnschr.*, 1920, 67, 1226.
10. Kastlin, G. J.: Agranulocytic Angina, *Am. J. Med. Sci.*, 1927, 173, 799.
11. Labbe, M., and Langlois, S.: Acute Purpura Hemorrhagica from Arsenical Poisoning, *Bull. et mem. d. hop. de Paris*, 1919, 43, 786.
12. Moore, J. E., and Foley, F. E.: Serious Reactions from the Salvarsan and Diarsenol Brands of Arsphenamin, *Arch. Dermat. and Syph.*, 1920, 1, 25.
13. Moore, J. E., and Keidel, A.: Stomatitis and Aplastic Anemia Due to Neoarsphenamin, *Arch. Dermat. and Syph.*, 1921, 4, 169.
14. O'Leary, P. A., and Connor, H. M.: Acute Purpura Hemorrhagica as a Complication in the Treatment of Syphilis, *Am. J. Syph.*, 1925, 9, 262.
15. Rabut, R., and Oury, P.: Purpura in the Course of Poisoning by Novarsenobenzol, *Presse med.*, 1922, 75, 810.
16. Smith, C. M.: Severe Bleeding and Purpura following the Administration of Neoarsphenamin, *Arch. Dermat. and Syph.*, 1925, 11, 237.
17. Vill, G.: Hemorrhages into the Skin and Mucous Membranes with Bone-Marrow Hypoplasia and Death from the Destructive Action of Salvarsan, *Munchen. med. Wehnschr.*, 1921, 68, 1675.
18. Vanderbilt Medical Department.
19. Dodd, K., and Wilkinson, S. J.: Severe Granulocytic Aplasia of the Bone Marrow, *J. Am. Med. Assn.*, 1928, 90, 663.
20. Nicholas, J., Gate, J., and Lebeuf, F.: Acute Purpura Hemorrhagica after Novarsenobenzol, *Ann. d. dermat. et syph.*, 1923, 4, 705.
21. Wilson, C. P.: Marked Monocytosis Accompanied by a Neutrophilic Leukopenia following Antisyphilitic Treatment, *Am. J. Med. Sci.*, 1929, 177, 88.
22. Vidal, F., and Bertrand-Fontaine: Grave Aplastic Anemia Associated with Purpura following Novarsenobenzol, *Bull. et mem. Soc. med. d. hop. de Paris*, 1926, 50, 980.
23. Callomon, F.: Purpura Hemorrhagica with Mematuria and Fatal Pulmonary Hemorrhage after Neosalvarsan, *Dermat. Wehnschr.*, 1922, 75, 1197.
24. Ugrumow, B., and Idelsohn, J.: Aplastic Anemia, *Deutsch. Arch. f. klin. Med.*, 1927, 157, 257.
25. Citron, J., and Hirschfeld, H.: Hemorrhagic Diathesis and Aplastic Anemia after Treatment for Syphilis, *Med. Klin.*, 1925, 21, 805.
26. Farley, David L.: Depressed Bone Marrow Function from the Arsphenamins, *Am. J. Med. Sciences*, 1930, 179: 2, 214.
27. Selling, F.: *Johns Hopkins Medical Bulletin*, February, 1910, page 33.
28. Rohner: *Arch. of Path. and Lab. Medicine*, 1: 521, 1921.
29. Santesson: *Arch. for Hygiene*, 31: 336, 1897.

AN INTERESTING SPINAL CORD TUMOR

By J. W. ALLEN, Lieutenant Commander, Medical Corps, United States Navy, and P. T. CROSBY, Lieutenant Commander, Medical Corps, United States Navy

The accurate localization of a cord tumor is rather difficult and is sometimes just "good guesswork"; but the general localization is fairly easily made after a careful neurological and serological examination.

The following case is interesting from two standpoints: First, the gradual march and chronological order of signs and symptoms; second, the presence of three urinary fistulæ which were operated on to offset incontinence and nephritic complications. The first sign of neurological involvement came in January, 1927, but the tumor was not excised until September, 1929.

CASE REPORT

Veterans' Bureau patient, age 34; admitted to ——— hospital, May 23, 1928; diagnosis, fistula of urethra.

Family history: Negative.

Previous history: Several attacks of gonorrhea with prostatic complications and strictures dating back to war service, 1918. Had been operated for strictures and prostatic abscess in 1923.

Present complaint: For about six months, during latter half of 1926, he felt prickly pains between scapulæ. These were just strong enough to keep him from sleeping well. In January, 1927, he noticed tingling in left leg and toes. States left leg "went to sleep" up to the knee. Gradual loss of strength in this leg progressed until by May he had to use a cane. In June, 1927, he experienced severe burning pain in left leg and thigh. Suddenly, during the same month, his right leg became involved with very little pain, but marked stiffness and paralysis. From a motor standpoint the right leg was now much worse than the left. From this time on until his hospitalization he gradually became worse. Girdle or corset sensations, stiffness of spine and legs, and shooting pains in lumbo-sacral region and down both legs began. When trying to get about the house, the legs would suddenly lock and cross at the thighs. Force was necessary to separate the legs. During these 10 months the symptoms gradually increased in intensity.

On admission, the neurological signs were loss of light touch, loss of pain (pin prick), loss of temperature sense. Deep touch remained. Right leg was somewhat edematous.

It is noted that patient tried to creep and apparently had some little control of the legs.

October 16, 1928: Pains in legs and back continue.

December 17, 1928: Patellar reflexes hyperactive; ankle clonus. Positive Babinski.

January 1, 1929: Below the sixth and seventh vertibræ, dorsally, patient does not feel cotton or pin prick. Abdominal reflexes absent. Abdominal muscles voluntarily active. Deep sensation present. No nystagmus.

January 20, 1929: Bed sores on both trochanters. Having difficulty with constipation.

January 31, 1929: Blood culture negative.

February 6, 1929: Bedsores at inner aspects of knees.

February 24, 1929: Sores improving. Now requires enemata for relief of constipation.

March 2, 1929: X ray, thoracic, and lumbar spine, negative.

May 20, 1929: Patient notices some return of sensation in left leg with warm feeling after massage.

September 4, 1929: Transferred to Chelsea Naval Hospital.

On admission, neurological examination as follows:

Pupils: Equal and react normally.

Cranial nerves: Negative.

Reflexes of upper extremities: Active and equal.

Superficial reflexes: Abdominals and cremasterics, absent.

Rabinski: Positive both feet. All confirmatories (Gordon, Oppenheim, Chaddock, Rosalino) positive both feet.

Patellars: Hyperactive with sustained clonus.

Achilles: Hyperactive with sustained clonus.

Sensorium: From soles both feet to level of seventh spinal segment (ensiform anteriorly and seventh spine posteriorly) there is loss of light touch, pain, vibration, and position together with heat and cold temperature sense. Deep touch was present throughout. Pain was present but greatly diminished over an area on left flank extending down almost to left trochanter.

Flexion of toes forcibly brought out the triple flexion of defense or spinal automatism. There was also present a constant rhythmic extension, flexion, and internal rotation of both lower limbs.

Just above the eighth segment and in the area of the seventh spinal segment was a band that reacted most peculiarly in that throughout this area pin prick became more painful than over normal skin of fifth and sixth segments and was interpreted to be hyperesthesia, but light touch and temperature sense were absent. The patient stated that this area coincided with the original prickly pain of 1926.

These sensory findings place the upper limit of complete loss of sensory function as the eighth dorsal segment. The seventh segment shows the increase of pain or hyperesthesia, and marks the absolute upper level of the pathological sensory disturbance. By adding two segments to our findings, we localize the compression of the cord at the fifth dorsal vertebræ. Certainly no higher, and perhaps lower in the sixth. It must be above the seventh because all abdominal reflexes are gone. There was also fingerpoint tenderness between the fifth and sixth vertebræ on the right side of the spine.

Laboratory findings:

B. U. N., 12.04 mgms. per 100 c. c.

Urine, negative.

Blood Kahn, negative.

White blood count, 11,300; polys, 73 per cent; coagulation time, 5 minutes.

Spinal fluid: Pressure, 8; 11 mm. Hg; cells, 4; globulin (Nonne-Appelt), strongly positive; serum albumin, strongly positive; Kahn, negative; sugar, 29.5 mgms. per 100 c. c.; gold curve, 0-0-3-3-3-2-2-2-2.

No xanthochromia. Jugular compression raised spinal pressure only 3 mm. Coughing had no effect. Partial spinal block.

September 17, 1929: Laminectomy fifth, sixth, seventh thoracic vertebræ. Skin incision to right of midline, 3T to 8T. Lamellæ of fifth, sixth, seventh, thoracic vertebræ removed and dura exposed. No tumor palpated. Dura incised in midline. Cord found to be somewhat anemic and all vessels shrunken in size. No pulsation of vessels noted. Very little spinal fluid escaped. Cord

constricted at lower lever of fifth lamella. Dura closed. By removal of more bone of right process of the fifth lamella, an extra dural tumor was exposed. Tumor dark in color, encapsulated, and about 3.5 by 2 cm. in size. Cord was pushed to the left and posteriorly and very much compressed. It was necessary to remove part of the lamina of the fourth thoracic to uncover the tumor which was friable, and was removed in fragments. Entire tumor and capsule enucleated. Wound closed with muscular layer drainage.

Pathological examination of tumor tissue: Fibroblastoma of Mallory (endothelioma).

Progress observations.

December 14, 1929, neurological: Patellars and achilles hyperactive with clonus. Babinski and confirmatories positive.

Sensorium: Patient can tell toes are being moved but can not say whether up or down. Vibration sense present down to sacrum, still absent both legs. Hyperesthesia over soles both feet. Pain present but diminished to knees on right leg. Left leg almost normal in response to pain stimuli. Temperature sense fairly good over left leg but disturbed over right leg and gross differences noted over upper right thigh. Patient can voluntarily move toes of both feet. Abdominal reflexes present but diminished.

May 24, 1930; neurological: Left leg—Sense of position good for gross movements of great toe. Pain (pin prick) present over whole leg. He is able to distinguish accurately between finger point touch and pin point, even to the lightest pressure over whole leg and foot. Light touch normal. Vibration sense still absent. Temperature sense normal. Babinski still positive but confirmatories are negative. Passive movement elicits no spasticity. Patient is able to flex and extend leg rapidly and touch without difficulty his right knee with the left heel.

Right leg.—Position very poor, can only distinguish that toe is moving, probably from sense of touch. Pain and temperature senses same as left leg, within normal limits. Light touch normal. Leg is still spastic on passive movement but much less so than at time of operation. Triple flexion present. Patient can touch left knee with right heel but with much effort. Dorso-lumbar muscles have lost their spasticity, making trunk flexion easily accomplished. The sensory findings of the whole trunk both anteriorly and posteriorly are now normal. Abdominal reflexes still markedly diminished. There is quite well-marked hyperesthesia over soles of feet. The patient is disturbed both day and night by shooting pains in both legs. Patient gradually, by use of an overhead frame, could move himself around his bed. Next, a walking frame was put in operation and fitted so that it resembled a baby walker and was provided with uprights with crutch arm pads. By June, 1930, he was walking up and down the ward five times a day with ordinary crutches. He was able to stand alone for one minute.

We now have hopes that the patient will become able to assume his place in the world after a period of two years. After having been a spastic paraplegic for approximately two years, this much recovery is remarkable.

We appreciate deeply, in connection with the treatment in this case, the continuous and careful work of the physiotherapy department and its director, Lieut. T. H. Hayes, Medical Corps, United States Navy.

GANGRENE OF THE PENIS CAUSED BY STRONG IODINE SOLUTION

By W. K. Hicks, Lieutenant, Junior Grade, Medical Corps, United States Navy

A 44-year-old seaman applied to the sick bay of the U. S. S. *Marblehead* on December 1, 1929, complaining of skin lesions and itching over his trunk and extremities. Small ulcers had resulted from the scratching of these isolated lesions. The medical officer had advised the use of mercurochrome and this solution apparently aided healing. When the small ulcers healed, reddened areas the size of a penny would remain and these gradually faded to a copper-brown color. New lesions continued to form.

A Kahn test taken January 15, 1930, was negative. During a week-end leave, two small lesions that were in every way similar to the skin lesions appeared upon the dorsum of the glans penis. The patient applied strong iodine solution to these lesions. The iodine had been purchased by the patient a few months earlier; the cork had been lost from the bottle and the solution had turned a black color. The following day, February 20, the glans was blistered and indurated and the shaft of the penis was swollen and reddened.

He was admitted to the sick bay of the *Marblehead* at this time. Thirty-six hours after the iodine application, the glans had become darker in hue and was very painful; his temperature was 103°. On February 22 there was less pain and the glans had become definitely gangrenous. Continuous wet packs of a mild antiseptic solution were applied.

On February 28 the glans was black, necrotic and shrunken, the line of demarcation following a plane that cut through the penis at the angle of the sulcus. Just behind the sulcus was a large raised collar of hard fibrotic scar tissue, the result of a circumcision in a previous year. At this time the collar was freely movable. A dorsal slit was performed and the glans was found to be bloodless and painless. The ring of scar tissue was incised. Irrigations of a weak bichloride solution were used as a cleansing and deodorizing procedure.

Laboratory examinations showed the following: White blood count, 10,400; red blood count, 4,800,000; hemoglobin, 90 per cent; blood smears, negative for parasites; urine, normal; Kahn test, negative.

On March 3 a sinus appeared at the sulcus, through which a part of the urin was passed. On March 5 the glans sloughed away, leaving a clean raw surface. The urethra protruded from the ventral portion of the shaft. By March 15 the stump had practically healed, the protruding urethra being drawn upward by the retracting scar tissue.

On March 5 a small ulcer appeared beside the urethra and extended inward enlarging as it progressed so that pain became severe and the patient was unable to rest at night. At this time, the former skin lesions recurred over the body and face. An old ulcer scar on the right shin became reinfected and a serous discharge could be expressed from it. Smears were negative for spirochetes or fungi. On March 7 a Kahn test was negative. On March 8, 0.4 grams of neoarsphenamine were given as a provocative injection. Two days later the blood Kahn was three plus, and on March 14 it became a strong four plus. The penile ulcer became less painful within 24 hours after the provocative dose, while the indurated area about the ulcer resolved rapidly and a serous discharge was present for a few days. On March 12 the lesions over the body were rapidly disappearing and the ulcers on the shin and on the penis were healing. By March 25 all the lesions had healed and the patient felt much improved. The skin of the penis rolled over the scarred area, protecting it and making a satisfactory prepuce. Antiluetic treatment was continued.

Twice in previous years the patient had had skin eruptions identical with the present eruption. On each occasion an injection of neoarsphenamine cured the condition after all other treatment failed.

The case presents several interesting possibilities. From appearances it is evident that this was not an acute infectious condition but one of dry gangrene. The most probable explanation for the sudden circulatory failure is that the iodine caused a thrombosis of the two dorsal arteries or veins supplying the glans. The iodine had been exposed to the air for at least several days, allowing the alcohol to evaporate and changing the solution from the standard 3 per cent to one of 25 to 50 per cent. In the patient's words, the solution was "as black as licorice." The dorsal arteries and vein are most superficial at the sulcus and the iodine was swabbed over the dorsal surface of the glans and sulcus.

It is possible that a syphilitic endarteritis was present in the penile dorsal arteries or their immediate branches, this condition acting as a contributing factor. The skin lesions also were probably due to endarteritis of the superficial capillaries.

A third possibility to be considered is the collar of scar tissue behind the sulcus. Intense edema might have caused a constriction of the penis but as the collar was still freely movable on his admission to the dispensary, it is doubtful if this could have been the essential cause.

Lacking reference facilities, only two cases from former experiences can be cited. One case lost the glans following an infectious moist gangrene; the second had the glans amputated because of a

malignant process. Both patients were able to continue sexual activity following healing of the penile stump.

STOCK SOLUTION OF GLUCOSE FOR INTRAVENOUS USE

By E. J. CHRISTIAN, Chief Pharmacist's Mate, United States Navy

Hospital Corps men are frequently called upon to prepare glucose solutions for intravenous injection. The usual routine of preparing, filtering, sterilizing, and waiting for the solution to cool results in a loss of time and in other unsatisfactory features. The time factor can be practically eliminated and the needs of the service better served by having sterile, concentrated solutions of glucose already prepared.

Sterile ampules containing 50 cubic centimeters of a 50 per cent solution of glucose can be purchased on open-purchase requisitions, but these are expensive and have no advantage over solutions which can be prepared by any activity equipped with facilities for sterilizing.

A 50 per cent solution can be prepared and sterilized in an autoclave and held in readiness for further dilution when needed. A flask with a long neck is preferred to the Erlenmeyer flask for this purpose, as a longer stopper is an advantage in keeping out molds which are prone to contaminate such solutions. If the solution becomes cloudy or develops a flocculent precipitate, it should be rejected. Also, the flask should be graduated. This can be accomplished with adhesive tape or a file, so that the amount of water lost during sterilization can be replaced.

If it is desired to keep the solution in individual containers, bottles, corks, and a graduate can be sterilized along with the solution in bulk, and after the bottles are filled the corks can be sealed with paraffin.

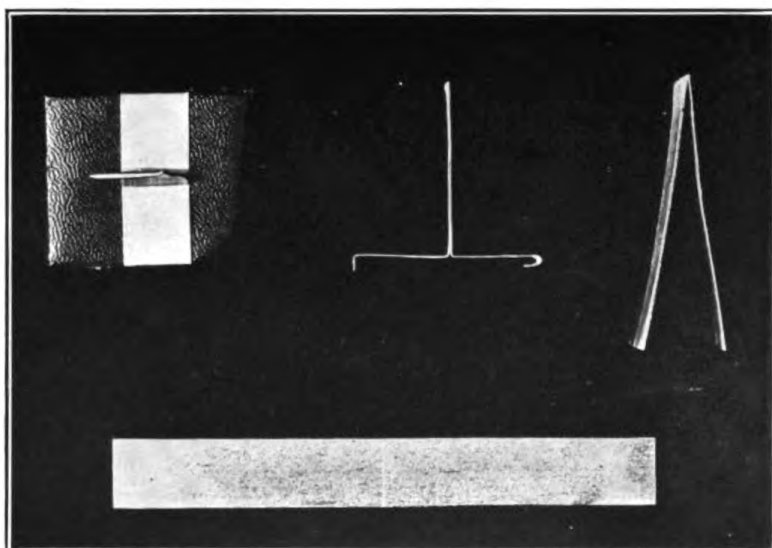
It is not recommended that large quantities be made at one time, as this may result in a needless waste. The solution should be inspected daily and the supply replenished as it becomes depleted through use or deterioration.

SIMPLIFIED TECHNIQUE FOR CONVERTING REGULAR DENTAL FILMS INTO USE FOR BITE-WING FILMS

By W. I. OGUS, Lieutenant Commander, Dental Corps, V. (S), United States Naval Reserve

The practical application of bite-wing films in routine dental X-ray examinations for caries and alveolar destruction has been conclusively demonstrated. Specially designed bite-wing films are on the market and are considered entirely satisfactory. The advantages of the special bite-wing film, however, can be maintained, and its increased

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SIMPLIFIED BITE WING FILM

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cost and the necessity of stocking an additional class of film eliminated, through the use of regular dental film in combination with a holder. The regular film, too, possesses certain advantages over the special film in that it is smaller and can be utilized in showing three teeth and three contact points. The special film, being larger, takes in a correspondingly larger field.

A home-made holder, readily made from a strip of aluminum foil, and which can be rinsed and sterilized, is shown in the accompanying illustration. This holder simplifies conditions for taking these exposures through the use of regular dental films.

DIRECTIONS FOR MAKING HOLDER

1. Cut strip of aluminum foil 4 by $\frac{1}{2}$ inches.
2. Fold strip into two.
3. Bend flaps $1\frac{1}{4}$ inches.
4. Curl ends.

18099—30—7

NAVAL RESERVE

APPOINTMENTS, THIRD QUARTER, 1930

Name	Rank	Appointed
Boudry, Marshall O.....	Lieutenant (junior grade), MC-V (G).....	Aug. 15, 1930
Cooney, Charles J.....	do.....	July 15, 1930
Hicks, Vonnice M.....	Lieutenant, MC-V (S).....	Sept. 11, 1930
Hotchkiss, Robert S.....	Lieutenant (junior grade), MC-V (G).....	June 24, 1930
Hughes, Arranda A.....	Lieutenant commander, MC-V (S).....	Sept. 13, 1930
James, Gordon M.....	Lieutenant (junior grade), MC-V (G).....	Aug. 22, 1930
Jones, Herbert F. H.....	Lieutenant, MC-V (S).....	June 26, 1930
Le Jeune, Francis E.....	Lieutenant commander, MC-V (S).....	June 24, 1930
Patterson, John K.....	Lieutenant (junior grade), MC-V (G).....	Aug. 22, 1930
Sams, Wiley M.....	do.....	Do.
Savage, Raymond J.....	Lieutenant, MC-V (S).....	Apr. 4, 1930
Stedman, Harold E.....	Lieutenant (junior grade), MC-V (G).....	July 15, 1930
Wear, Harry H.....	Lieutenant, MC-V (S).....	Apr. 24, 1930
Williams, James P.....	Lieutenant (junior grade), MC-V (G).....	Aug. 18, 1930

TRANSFER

Name	From—	To—
Adams, John Q.....	Lieutenant, MC-V (G).....	Lieutenant, MC-F.

NOTES AND COMMENTS

LETTERS OF COMMENDATION

In accordance with the statement made in the preface of the **BULLETIN**, the Surgeon General of the Navy appointed a board to select the papers published in the **BULLETIN** during the year 1930 which it considered to be worthy of letters of commendation. As a result of the selections made by the board, letters of commendation have been sent to the officers named below for the papers which appear opposite their names:

Lieut. Commander P. W. Wilson, Medical Corps, United States Navy, **The Frontal Attack on Yaws, a Plea for a Change in Strategy** (January).

Capt. D. G. Sutton, Medical Corps, United States Navy, **Psychology in Aviation** (January).

Lieut. Commander G. H. Mankin, Medical Corps (VG), United States Naval Reserve, **Individual Submarine Escape** (January).

Lieut. Commander F. S. Johnson, Medical Corps, United States Navy, **Report of Two Hundred Examinations for Acute Alcoholism Made at the United States Naval Hospital, Brooklyn, N. Y.** (January).

Lieut. Commander J. E. Houghton, Medical Corps, United States Navy, **Combined Precipitation (Kahn)—Complement Fixation (Bass) Tests in the Serum Diagnosis of Syphilis** (April).

Lieut. Commander J. M. McCants, Medical Corps, United States Navy, **Typhoid Fever—Report of Three Cases Diagnosed and Treated on Board the U. S. S. *Relief*** (April).

Commander J. R. Phelps, Lieut. O. A. Smith, Lieut. (Junior Grade) H. H. Carroll, Medical Corps, United States Navy; Chief Pharmacist's Mate W. A. Washburn, and Chief Pharmacist's Mate K. E. Beagley, United States Navy, **Experimental Treatment of Filariasis with Intramuscular Injections of Oil of Chenopodium** (April).

Commander E. W. Brown, Medical Corps, United States Navy, **The Value of High Oxygen in Preventing the Physiological Effects of Noxious Concentrations of Carbon Dioxide** (July).

Commander J. R. Phelps, Medical Corps, United States Navy, and Chief Pharmacist's Mate W. A. Washburn, United States Navy,

Toxic Effects of Arsenical Compounds Employed in the Treatment of Syphilis in the United States Navy (July).

Capt. W. M. Garton and R. G. Heiner, Medical Corps, United States Navy, Mobile Battalion Aid Station Equipment for Use with United States Marine Corps Expeditionary Forces (October).

Lieut. C. M. Shaar, Medical Corps, United States Navy, Anti-Pendulum Extension Apparatus and Fracture Frame (October).

Lieut. (Junior Grade) T. M. Arrasmith, Medical Corps, United States Navy, Influenzal Pneumonia (October).

Capt. M. A. Stuart, Medical Corps, United States Navy, Tuberculosis (October).

ANNUAL REPORT OF THE SURGEON GENERAL, UNITED STATES NAVY, 1930

The Medical Department activities discussed in this report occurred during the fiscal year ended June 30, 1930. The statistics concerning morbidity and mortality rates and other data pertaining to health conditions of the Navy are for the calendar year 1929.

Annual health examination.—Of the 9,745 officers examined 89.3 per cent showed defects worthy of note. In the 1929 examination 93.34 per cent of the officers showed these defects. Most of the defects were of a trivial nature and were not such as to disqualify officers for the performance of their duties. As in previous years, the two most common defects were errors of refraction and overweight.

The same defects occupied the first 13 places as in the 1929 examination.

Defects found in more than one-half of 1 per cent of officers are listed below:

	1930	1929	Order of fre- quency, 1929		1930	1929	Order of fre- quency, 1929
Error of refraction.....	24.9	24.3	1	Defective color perception....	1.0	1.9	8
Overweight.....	17.4	18.5	2	Tonsillitis, chronic.....	1.0	1.8	10
Underweight.....	10.8	12.5	3	Trichophytosis.....	1.0	1.0	11
Deviation, nasal septum.....	8.4	8.3	4	Tachycardia.....	.9	.7	12
Defective hearing.....	6.9	6.8	5	Albuminuria.....	.6	.6	13
Hypertrophied turbinate.....	3.4	2.6	7	Varicocele.....	.6	.4	18
Hemorrhoids.....	2.3	2.9	6	Cardiac arrhythmia.....	.5	.2	20
Hernia.....	1.2	1.3	9	Flat foot.....	.5	.3	22

Death rate.—A total of 394 deaths occurred, making the death rate from all causes 3.36 per 1,000. This rate is lower than that for any previous year except 1922 and 1926 when the rate was 3.23 and 3.03, respectively. The median rate for the preceding five years is 4.18, and for the 5-year period 1919–1924 is 3.78.

It is worthy of note that almost exactly one-half of the death rate was caused by injuries and poisons during 1929 (1.67 for diseases and 1.69 for injuries and poisons). The death from external

causes has slightly exceeded that from diseases during each year since 1922.

The leading causes of death and their order of frequency during the last three years are shown in the following table. The same causes occupied the first 11 places (although not in the same order of frequency) in each of the three years.

Their order of importance is indicated in parentheses.

NUMBER OF DEATHS AND ORDER OF FREQUENCY

	1929	1928	1927		1929	1928	1927
Accidental injuries, exclusive of drowning.....	110 (1)	119 (1)	100 (1)	Cerebrospinal fever.....	20 (6)	27 (5)	14 (9)
Drowning.....	50 (2)	70 (2)	90 (2)	Pneumonia.....	15 (7)	37 (3)	17 (6)
Suicide.....	29 (3)	35 (4)	44 (3)	Influenza.....	14 (8)	16 (8)	25 (5)
Diseases of circulatory system.....	27 (4)	16 (9)	15 (8)	Neoplasms.....	13 (9)	17 (7)	12 (10)
Tuberculosis.....	22 (5)	23 (6)	27 (4)	Syphilis.....	12 (10)	9 (11)	10 (11)
				Appendicitis.....	9 (11)	13 (10)	16 (7)

Flight hazards.—There has been an almost progressive decline in aviation fatalities per unit of flying hours during the last eight years. The following table shows the fatalities per 10,000 flying hours since 1920:

1921.....	9.8	1926.....	2.3
1922.....	3.8	1927.....	2.5
1923.....	3.2	1928.....	1.5
1924.....	6.9	1929.....	1.0
1925.....	3.7		

Morbidity rates.—There were 23 different conditions, each of which caused more than 10,000 sick days during the year. They are listed below in the order of frequency of admissions. Corresponding figures for the same conditions are shown for the year 1928. Their order of importance with respect to sick days is indicated in parentheses:

	1929		1928	
	Admissions	Sick days	Admissions	Sick days
1. Catarrhal fever.....	9,138	56,273 (4)	11,691 (1)	71,963 (4)
2. Gonococcus infections.....	8,776	121,585 (2)	8,353 (2)	111,634 (2)
3. Injuries and poisonings.....	6,969	145,532 (1)	6,824 (3)	150,307 (1)
4. Tonsillitis.....	5,935	76,803 (3)	5,947 (4)	75,022 (3)
5. Chancroid.....	3,580	16,867 (14)	3,362 (5)	14,037 (19)
6. Syphilis.....	2,540	55,229 (5)	2,633 (6)	60,398 (5)
7. Cellulitis.....	1,826	23,238 (11)	1,890 (8)	22,506 (12)
8. Appendicitis.....	1,511	45,983 (6)	1,248 (11)	42,509 (6)
9. Influenza.....	1,479	15,819 (17)	2,217 (7)	17,807 (14)
10. Malaria.....	1,235	39,147 (8)	1,647 (9)	42,974 (7)
11. Bronchitis.....	1,136	30,971 (9)	1,585 (10)	33,633 (9)
12. Vincent's angina.....	867	10,947 (22)	903 (12)	12,266 (21)
13. Cholangitis, acute.....	559	11,964 (20)	638 (14)	15,095 (16)
14. Deviation nasal septum.....	559	14,409 (18)	556 (15)	14,444 (18)
15. Trichophytosis.....	539	16,760 (15)	362 (19)	9,712 (23)
16. Otitis media.....	532	16,335 (16)	663 (13)	21,358 (13)
17. Hemorrhoids.....	502	10,907 (23)	455 (16)	10,995 (22)
18. Bubo, nonvenereal.....	427	12,648 (19)	434 (17)	14,657 (17)
19. Hernia.....	398	23,048 (12)	382 (18)	24,397 (11)
20. Arthritis.....	350	26,253 (10)	304 (20)	24,431 (10)
21. Tuberculosis.....	206	40,339 (7)	254 (21)	40,218 (8)
22. Ulcer, duodenum.....	122	11,733 (21)	110 (22)	13,159 (20)
23. Dementia præcox.....	70	18,336 (13)	84 (23)	16,973 (15)
Total admissions, all causes.....	64,336	1,328,353	68,291	1,364,756

It is noted that the same five conditions caused each more than 50,000 sick days during each of the last three years, and appear in almost the same order for the three years.

	Sick days		
	1929	1928	1927
Injuries and poisonings.....	145,532	150,307	145,656
Gonococcus infections.....	121,585	111,634	108,354
Tonsillitis.....	76,803	75,022	77,855
Catarrhal fever.....	56,273	71,963	55,887
Syphilis.....	55,229	60,398	60,188

Administration of arsenicals in the treatment of syphilis.—Despite the decline in the syphilis rate during the last three years (24.57, 22.69, and 21.64 admissions per 1,000 men) there has been a gradual increase in the use of arsenicals since 1925, as follows:

	Number of injections			Number of injections	
	Arsphenamines	Tryparsamide		Arsphenamines	Tryparsamide
1925.....	47,717	1,160	1928.....	80,000	2,551
1926.....	63,163	1,232	1929.....	83,041	2,383
1927.....	74,478	2,054			

CEREBROSPINAL FEVER

Although cerebrospinal fever has been declining in the Navy during the last two years, in regard to both death rate and admission rate, the case fatality rate remains high and the disease continues to hold a high place among the causes of death in the Navy. During 1928 it caused 27 deaths, and thus took second place among diseases causing death in the Navy. In 1929 it took third place, causing 20 deaths. However, the admission rate dropped from 72 per 100,000 in 1928 to 57 per 100,000 in 1929. Death rates for the first two quarters of 1930 are now available; these show four deaths from cerebrospinal fever for the 6-month period. If this rate continues during the second 6-month period of 1930, the disease will drop many places on the list.

The rates for cerebrospinal fever in the Navy have followed rather closely the trend of the disease throughout the United States since 1925. The registration area of the United States has experienced a progressive increase since 1925, although the figures now available for 1930 indicate a decline for the year. During the first 22 weeks of 1930, 5,400 cases were reported by 47 States, as compared to 5,900

cases for the same period in 1929. The number of cases reported throughout the United States for the past five years is as follows:

1925.....	1,859
1926.....	2,228
1927.....	3,204
1928.....	5,781
1929.....	9,660

Two articles of considerable merit appeared on the subject of meningitis in the July, 1930, number of the Kentucky Medical Journal.

The first of these, by J. A. Miller, concerns the pathology and the laboratory diagnosis. Miller states that as healing progresses, the fibrin is dissolved and usually the repair is perfect. Occasionally, however, the serous membrane is necrosed in small areas, with necrotic foci extending into the cortex. It is these areas of necrosis that give rise to scar formation in the meninges and, occasionally, occlusion of paths of the cerebrospinal fluid. The chronic cases are really hydrocephalics rather than chronic meningitis.

The convolutions of the brain are practically always flattened, and the sulci made shallow by the increased intracranial pressure, and this pressure is more the result of swelling of the brain than the accumulation of fluid.

* * * Meningococcic pneumonia, which grossly resembles pneumococcic pneumonia, meningococcic endocarditis, and meningococcic arthritis have been observed, and in these lesions the reaction consists of fibrinopurulent exudate which may or may not be tinged with blood or blood pigment. Occasionally there is localized peripheral neuritis, which, presumably, is always the result of localization of the organisms in the peripheral nerves.

The second article, by Morris Flexer, deals with treatment. The author states that serum should always be at hand when doing the first diagnostic puncture, because turbidity of the fluid indicates immediate injection of the serum. As much fluid as possible should be drained, and the amount of serum injected should be from 5 to 10 cubic centimeters less than the fluid withdrawn. Pressure should never be used in injecting serum; the gravity method alone should be used.

The author believes in early intravenous administration of serum after a definite diagnosis has been made. If a rash is present and the blood culture positive, further intravenous serum is indicated. Intravenous serum should never be used without having adrenaline in a syringe at hand.

The meningitis division of the research laboratory of the New York City Health Department, established by Doctor Park, 19 years ago, in drawing conclusions from over 1,000 cases, feels that at least four injections should be given, regardless of the rapidity of improvement. The criterion for stopping serum in the face of an improving clinical picture is the absence of organisms on smear and culture and the return of the spinal fluid sugar and normal

pressure. The cell count is not an accurate guide as it is quite variable. Further puncture may be necessary to reduce pressure, but in all such cases one must be suspicious of a "walled off" process causing irritation.

Cisternal puncture should be done in cases of dry spinal taps or in cases where the fluid is so purulent that drainage is poor. At times irrigation of the spinal canal by cisternal and lumbar puncture with normal saline may be of help * * *.

Undoubtedly the weak link in the chain in serum treatment of meningitis is the quality of commercial serum available. Wright and coworkers in the babies' ward of the New York Post-Graduate Hospital have gone into the matter of serum very thoroughly. They used seven different sera, finding one in the lot that was effective. In 44 cases, 14 died; of the 14, 10 of them died before the good serum was used; 2 of the 4 patients that died after using this serum were admitted moribund. In reality it means that using the effective serum, 4 out of 34 died, a mortality of a little over 10 per cent. Among the interesting points they emphasize is the fact that the agglutinating titer of the serum is no index of its therapeutic value. Apparently the only test of a serum is the result obtained after its employment, and if not getting the desired effect from one brand of serum, quickly change to another with the hope that one good one will be found.

STUDY OF INFLUENZA MORTALITY IN SIX EPIDEMICS, 1920-1929

The Public Health Service has recently completed a study of influenza mortality in six epidemics. This study is based on weekly death rates from respiratory diseases recorded as influenza and pneumonia in about 95 cities of the United States during the period 1920-1929.

From January 1, 1920, to the middle of 1929, six epidemics of more or less national extent have occurred in the United States—1920, 1922, 1923, 1926, spring of 1928, and the winter of 1928-29. Judging by the rates in the 95 cities, which seem to be only slightly higher than rates for the country as a whole, these six epidemics caused in excess of the normal or expected seasonal mortality from respiratory diseases recorded as influenza and pneumonia approximately 250,000 deaths in the country as a whole—a total of nearly one-half as many deaths as occurred in the United States during the great pandemic of 1918-19. About one-fifth of these deaths, or 50,000, occurred during the recent epidemic of the winter 1928-29, and two-fifths, or 100,000, occurred during the sharp epidemic of the early months of 1920.

Although these six epidemics were more or less nation-wide in extent, the various sections of the United States were by no means equally affected. In the instance of several of the smaller epidemics there appeared to be whole sections of the country that were not affected. On the other hand, certain sections of the country experienced fairly sharp epidemics in years when the rates for the country as a whole did not indicate any influenza-pneumonia deaths in excess

of the median weekly rates. An example of this is an epidemic in the West South Central cities which occurred in the early months of 1925, a year when the remainder of the country appeared to be relatively free from influenza.

The point of origin and direction of progress of these six epidemics varies a great deal. Nearly every one of them arose in a different section of the country. The 1920 epidemic arose in the East North Central section and progressed very rapidly to all other sections of the country. The 1922 epidemic arose in the East, probably in the Middle Atlantic section, and the 1923 epidemic arose in the East South Central section. The 1926 and the 1928-29 epidemics arose on the west coast, and the little epidemic of the spring of 1928 probably arose in the Mountain or West South Central section.

The rate of progress across the country varies a great deal in the different epidemics. Considering the 95 cities as a whole, however, there is more uniformity in the length of the epidemic. In 1920 the central half of the deaths occurred in a period of about 16 days. In the epidemics of 1928-29, 1922, and 1926 the central half of the deaths occurred in periods of 21, 22, and 23 days, respectively. In the small epidemic of the spring of 1928 the period was 27 days, and in the epidemic of 1923 the period was 30 days. The 1923 epidemic seems to show the least time concentration of any of these recent outbreaks. In the case of all the other epidemics the excess rate rose and fell at about the same rate, but in 1923 the rise to the peak was considerably slower than the fall of the curve to the normal level again.

REAL PROBLEMS OF MODERN MEDICINE

Dr. Martin E. Rehfuss delivered the 1930 oration in medicine before the Illinois Medical Society. The address appears in the July, 1930, number of the Illinois Medical Journal.

Doctor Rehfuss looks into some of the problems of modern medicine with such penetration and sizes up certain of them in such an engaging and convincing way that excerpts of his address are quoted below at some length.

* * * There is too much of a tendency to take things for granted, to assume that the status of any given problem in medicine is settled, when there is scarcely a question in the entire realm of medical science which is completely and satisfactorily settled * * *.

Many diseases indicate chronic infection, and until we find the systemic solution against chronic infection we do not kill it. We can pull teeth, remove tonsils, extract gall bladders, and surgically separate ourselves from part of the pathology, but the remainder after years is still there. Only through the circulation or through some specific process of immunity does it seem likely that we will arrest infection—the great problem of the twentieth century * * *.

No problem to-day equals that of the chronic invalid. We have had the most remarkable progress in the handling of acute disease; in particular those diseases which invade the human host. All over the world to-day, progress is being made slowly and insidiously, but always forward, punctuated here and there with some scintillating discovery, such as that of insulin, which lights the way and dispels gloom. As Park and his coworkers point out, original discoveries are still adding to our knowledge of germ diseases, and apart from the conquest of many of the infectious diseases by special methods the way has been cleared to an even more thorough study of some of those diseases which are still obscure. This observer maintains that the outlook is favorable for obtaining eventually either through serums, attenuated cultures, or through toxic substances produced by the microorganisms themselves, means of immunizing if not actually curing an increasing number of specific infections * * *. Since the war the extensive work on practical immunization against diphtheria has had wide adoption, while the discoveries on the etiology of scarlet fever in 1923 and 1924 bring us up to the present time.

* * * It was my privilege in 1912 to be a member of the class of Pasteur Institute in Paris, and what a remarkable faculty it was. Metchnikoff was propounding his theories of intestinal bacteriology and the rôle of the phagocytes, Roux was the director and one of Pasteur's original assistants, and so was Nicolle. I can recall Laveran with his white beard, and I can imagine with what strange delight he must have first gazed on the malarial parasite. There were many in that distinguished group—Haffkine, the hero of the Manchurian plague; Besredka, of sensitized vaccine fame; Widal, of the Widal reaction; Chantemesse, and how many more with only the truth for their mistress, striving in every way to throw light on disease. No one can do justice to the enthusiasm or the "esprit de corps" which actuated that little group, and made them keep the faith.

* * * Of 46 infections which affect the genus homo only dengue, measles, glandular fever, psittacosis, rubella, mumps, pertussis, smallpox and chicken pox are without demonstrable specific causes, and there is considerable evidence that the last five are due to some form of filtrable virus. * * * In 25, or nearly one-half, we have some definite prophylactic measures; in 6 we have specific immune material; in 16 we have more or less specific but nevertheless questionable immune therapy; in 7 we have almost specific drug or chemotherapy, notably in malaria and in the spirilloses. In 33 the mortality has been definitely reduced, and in some the disease has been definitely reduced, and in some the disease has almost disappeared, while 6 have practically no mortality. * * * What a wonderful chapter of achievement and one which is in a sense appalling, and yet out of this list of diseases which affect man we have two or three groups which still resist the efforts of the scientists and concerning which we are in urgent need of help. Common colds, influenza, pneumonia on the one hand, and, on the other, measles, German measles and mumps. It may be possible to save our consciences with the statement that the latter are due to the filtrable viruses on the one hand, while a small but well recognized group of streptococci, pneumococci and B. influenza on the other are responsible for the cause of the trouble. The fact remains that this group perhaps more than any other still resists the efforts of the clinician and research worker. * * *

* * * It is apparent that sooner or later practically every individual, if he lives long enough, will become the subject of chronic diseases, and that his chronic disease seeks expression in one or more groups of organs

in the body resulting essentially in functional impairment and lessened efficiency. The real problems of to-day, as I see them, are not necessarily the handling of the acute infections which have yielded so marvelously to the combined assaults of the research worker, the clinician and public health official, but the chronic ailments which we see on every side. I refer to the chronic heart, chronic kidney, chronic digestive, chronic pulmonary, and chronic nervous diseases. These are real problems engaging the attention of every medical man, and too often carried in despair to members of cults not above question who try to help when the regular profession passes them by. * * * But how many of the profession know how to treat the chronically infected individual, the patient with peptic ulcer, chronic cholecystitis, cholelithiasis, colitis or even constipation, renal disease in all its manifold associations, and the various chronic diseases which affect the myocardium. It is the liver case, the ulcer case, the bowel case, and the kidney case, everywhere, who needs the benefit of modern methods.

Take for instance peptic ulcer. This is seen everywhere, and how it is treated! The patient is told to follow a diet. In a few days his symptoms disappear and later he has a recurrence, but the recurrence may be hemorrhage or perforation. In less than a week the patient with uncomplicated ulcer of the duodenum is comfortable on proper treatment—but is he cured? NO! and he never will be until the profession realizes that peptic ulcer is a chronic ailment, that the average history of peptic ulcer is three or four years or more in gastric ulcer and seven years in duodenal ulcer, with many individuals who have a history of almost twenty years. Modern medicine says that in the great majority of cases where you can diagnose this affection, that as soon as you do locate it you should do several things. First, you should take the patient in your confidence and outline for him the natural history of the disease. Explain that it takes six months to several years or more to heal the disease; explain to him that no symptoms do not mean cure; explain to him that if he has an ulcer he must readjust his life and live in such a way, with periodic checkups, until X-ray examination and analysis show the lesion to be healed. * * * This real problem demands precise diagnosis, X-ray control, readjustment of living, certain don'ts, a knowledge of dietary indications, and reasonable checkups, and when these are followed through the results are *more brilliant than most of the textbooks of medicine acknowledge*. * * *

Another real problem is gall-bladder disease. Gall-bladder disease is the commonest cause of upper abdominal indigestion and gives rise to the most bizarre symptomology. It may be as plain as anything could be with an attack of colic which couldn't be anything else, or it may be an insidious thief by night causing only insomnia, flatulence and a sense of physical deterioration. To me gall-bladder disease is always an end result * * * Gall-bladder disease can as effectively serve as a focus of infection as do tonsils, teeth, sinuses, and prostate. It causes myocardial manifestations in almost one-half of all chronic cases; in less than that it causes joint disturbances, and nearly all of these sufferers have nervous disturbances. Does the removal of the organ cause this sequential pathology to disappear? Not in my experience, and I have examined several hundred who had had gall-bladder operations. The reason is simple enough. The surgeon can only remove the end result; the gall bladder, and if that causes the pain, the pain is removed, or if that causes the flatulent indigestion, that may disappear; but he cannot remove the liver, the pancreas, or for that matter, the heart which is affected.

* * * For 15 years I have systematically cultured the nose and throat, the bile and the bowel wall. Time and again I have obtained the same organ-

isms in the colon as those encountered in the nose and throat and in the duodenum, and how many times have I encountered a nonhemolytic streptococcus in the sigmoid which in every respect was similar to that found in the throat. What is the significance of all this? I do not know, but for years, ever since I left Pasteur Institute I have tried vaccination with exceedingly small doses over long intervals, and I believe that my results speak for themselves. You may ask me how do I know that I am right? I answer that I am not sure and I can only judge from the results on the patient. But, on the other hand, if you can tell me any method other than that of bacterial immunization where infection is widespread which has an iota of reason in its administration, I would like to know about it * * * I feel, therefore, that in all cases of cholecystitis of the infection variety, that the bacteriological treatment comes first. You may fail either because you did not get the causative organism, or because instead of gradually teasing immunity, you overwhelm it by large doses.

* * * There is a diet for the acute or subacute gall bladder, and the diet is the low cholesterol diet and many of these sufferers are made comfortable. Very early they learn to eschew fried foods. Parturier wrote of the psychology of gall-bladder disease, pointing out that many are chronically tired, sleep poorly, because the conscious gall bladder probably makes its most expulsive effort after the evening meal. Most of them are constipated, the constipation being usually of the spastic type, and the left colon is usually over sensitive, probably due to emotional as well as digestive disturbances. Here, again, there is a method of living, a definite program, which includes the elimination of infection, the proper dietary, and most of all, the control of the bowels, because the bowels control the portal blood, and the portal blood determines the character of the work performed by the liver cell, and the liver cell determines the character of bile which enters the gall bladder. * * *

Let us therefore make a careful diagnosis, take these patients into our confidence, alter their lives, educate them on matters of diet, on bowel control, on the elimination of infections, and then use the weapons which modern medicine has given us. Use the modern cholecystogram and the duodenal tube intelligently and not fanatically, and you will be surprised at some of the results which are obtained.

* * * Few of us have applied the knowledge of modern science to our problems and how long it takes before any but the most ephemeral things are immediately applied to the sick. In no group of cases is a carefully planned existence by a thoughtful physician of more value than in the cardio-renal group. * * *

PROMOTION OF MEDICINE AND PHARMACY

On May 13, 1930, the one hundred and tenth annual United States Pharmacopœial Convention was held in Washington. The presidential address, by Prof. Reid Hunt, appears in the July 18, 1930, number of Science.

This is one of the oldest medical organizations in America, and the United States Pharmacopœia is the oldest national pharmacopœia of its type. It now has an international character and has been translated into Chinese and Spanish.

The principal function of these conventions is the correct labeling of drugs and elimination of useless drugs from the list. The need for

this may be seen in the facts that one drug (epinephrin) was passed forward under 35 different names and in the early years of the convention one of its presidents characterized many of the listed drugs as being "no more useful or active than brick dust." In the course of three decades, no fewer than 573 articles of the "brick dust" type were stricken from the list.

The convention has, from the beginning, adhered closely, in practice and in spirit, to the wording of its article in incorporation: the "encouragement and promotion of the science and art of medicine and pharmacy by selecting by research and experiment and other proper methods—such materials as may properly be used as medicine."

In general, the drugs listed in 1820 resulted from empiricism and were found as such in nature, while those added during the following 110 years came from pharmacological experimentation and were produced synthetically. Several of the drugs listed in the early days, though well known, were not employed in the valuable purposes to which they are put to-day. Among this class may be mentioned such drugs as ether, Epsom salt, and amyl nitrite. And arseno-benzene, known to chemists in 1875, needed the genius of the pharmacologist, Ehrlich, who in 1910 transformed this uninteresting compound, by the simple introduction of hydroxyl and amino groups, into a drug which has greatly changed the outlook in syphilis.

* * * The effective anesthetic dose of the present general anesthetics is more than 50 per cent of the fatal dose—a smaller margin of safety than with any other class of important drugs. The essential action of anesthetics seems to be the blocking of the passage of impulses to the brain at certain synapses; impulses coming from the brain to peripheral organs may be blocked by drugs in a thousandth or even millionth of the fatal dose.

A slogan which has done much to retard rational therapeutics is the "healing power of nature." Nature is certainly not very active in healing cancer, syphilis, tetanus, amebic dysentery, yaws, diabetes, myxedema, hook-worm, and many other diseases, many of which may now be relieved or cured by drugs. There is truth in Benjamin Rush's famous remark that nature should be turned out of doors and efficient art substituted for her.

* * * Never in the history of the world have the possibilities been so great. When ether, chloroform, chloral hydrate, amyl nitrite, phenol, etc., were introduced into medicine, the number of synthetic organic chemicals was very few; they were numbered in hundreds, or at most in a very few thousands. A year or two ago the organic chemists had already carefully described the physical and chemical properties, methods of synthesis, etc., of 258,000 organic compounds; about twenty new ones are being added to the list every day and, if there were a demand for them, they could be increased a hundredfold. Perhaps the pharmacologist would feel that a fair amount of knowledge is available as to the possible therapeutic value of two or three thousand of these; he can find casual references to some of the physiological effects of three or four thousand more, but, even with these, he is prepared for such surprises as occurred in connection with cocaine, acetanilid, phenol, simple derivatives of arsenobenzene, etc.

Little indeed is being done to test these new compounds for possible medicinal value; at the present rate of progress it would require not only decades but centuries, perhaps a millennium, for the medical profession to examine what the chemists already have to offer.

* * * It is difficult to avoid the conviction that when the historian of the future discusses the present status of medical research in the United States, when he notes what the study of drugs has already meant to the human race and when he thinks of the quarter of a million or more untested preparations on the chemists' shelves, the present will seem one of the darkest periods in medicine; he may even find a parallel between the attitude of some of those now responsible for the trend of medical research and the complacency of Percival Pott who in 1779 thanked God that his contemporaries (who had ether but did not use it) were not cruel like their predecessors.

PSITTACOSIS

The leading article in the July 19, 1930, number of the Journal of the American Medical Association comprises an exceptionally well written and comprehensive discussion of psittacosis, with a complete report of a clinical and Röntgenologic study of seven cases. The authors are Lieutenant Commander E. Peterson, Lieut. O. B. Spalding, and Lieut. Commander O. Wildman, Medical Corps, United States Navy. The cases were observed at the Naval Hospital, Washington, D. C.

The recent "epidemic" seems to have arisen in the summer of 1929 in Cordoba, Argentina, where parrots are brought in large numbers from the Amazon region, for distribution to many foreign ports.

The cases reported in this article were laboratory infections which occurred at the United States Hygienic Laboratory, Washington, D. C. Eleven cases occurred at the laboratory; two by direct contact with infected parrots; the other nine are difficult to explain as the patients, although laboratory workers, were not connected with the psittacosis investigations and did not enter the rooms where these investigations were in progress.

The symptoms noted in these cases were as follows:

After an incubation period of from 8 to 10 days the disease begins to manifest itself. The first symptom is usually a chill or sense of chilliness, soon followed by a distinct rise in temperature. Headache may come on during the first day and persist for several days. One of our patients did not experience any headache. Perspiration is the rule during the first week of illness. Appetite is commonly lost. The tongue becomes coated early; the center of the tongue may be chalky white and the edges red; the coat sometimes is brownish. Abdominal distention is common, often associated with constipation.

The severity of the disease is definitely associated with the degree of lung involvement, which apparently is the determining factor in the development of the toxemia.

When the lung involvement is comparatively small the patient is not very sick. The infiltration is then as a rule confined to one lobe; the patch involved is small, but the lesion creeps along from one part of the lobe to another,

the areas previously involved clearing up. It finally seems to find its definite place, where it remains sometimes for a long period before complete restoration takes place.

In these mild cases respiration seldom goes over 24 a minute, and the pulse is definitely below 100, often between 80 and 90 in spite of the fact that the temperature may rise to 103.5° F.

In the more severe cases a whole lobe or, indeed, two or more lobes may become involved. In these cases the picture may resemble that of lobar pneumonia with rather rapid breathing, cough, and expectoration of rusty sputum. Our cases 1 and 4 would come in this group. Other cases may resemble typhoid, with marked weakness, apathy, tremors, and subsultus tendinum. Case 7 would fall in this group.

Headache and abdominal distention are important symptoms in the severe cases. Perspiration is a pronounced feature throughout the disease. The spleen could not be palpated in any of the cases. The liver descended from one to two fingerbreadths below the costal margin in cases 1, 2, and 5.

Relapses do occur. In our series, cases 3 and 6 were readmitted to the hospital, suffering from the same symptoms as on previous admission but in a milder form. None of them showed any pulmonary involvement. Fall in temperature and recovery occurred within a few days.

X-ray chest plates were taken daily in all the cases.

The characteristic features were, first, a small faint cloud of equal density, the cloud enlarging and reaching its maximum size and density about the fourth day. This began at the base of the left lower lobe in each case. There was no mottling, as in broncho-pneumonia, and the shadow was less opaque than in lobar pneumonia. As the shadow crept upward, it left normal appearing lung tissue behind. The X-ray features were so characteristic as to form the determining factors in the early diagnosis.

An absence of leukocytosis was a feature in all cases. This was associated with a distinct shift to the left of the neutrophils. This shift reached its maximum during the height of the disease and was accompanied by a distinct fall in the number of lymphocytes and absence of eosinophils. With the occurrence of lysis and general improvement, a normal distribution rapidly established itself.

In all cases except case 1, an albuminuria was present; case 7 at one time showed 2 per cent albumin in the urine. A few hyaline and granular casts were the rule.

Repeated blood cultures were negative in all cases. Cultures of feces and urine have failed to show any pathogenic organisms.

In view of the negative agglutination tests with *B. psittacosis*, the authors are inclined to believe that this organism plays no part in the etiology of parrot fever.

Six of the patients were treated with convalescent serum. The only fatal case was that of the patient who did not receive the serum.

PROGNOSIS OF PLEURISY WITH EFFUSION

Fred W. Gaarde, Rochester, Minn. (Journal A. M. A., July 26, 1930), reports on 126 cases of idiopathic pleurisy which were studied for the purpose of ascertaining, if possible, the factors that influence prognosis. The disease was found to occur more frequently in the second and third decades, although the incidence of death was not out of the proportion to that in other decades. There were not enough patients in the first decade to warrant any definite conclusion as to prognosis. Thirty-five of the 126 patients are dead; 29 are known to have died of pleurisy, tuberculosis, or some process that could be traced directly to the pleurisy. Eighteen of the patients died within the first year, 5 died within the second year, and 4 within the third year. After the first three years, the deaths are divided into 3-year periods. Of the 18 who died within the first year, many did not recover completely from the original attack. Twenty-eight of the 35 patients died within a period of 5 years. The cause of death of the remaining 6 patients is unknown; it may or may not have been due to tuberculosis or recurrence of the pleurisy. Eight patients are still having trouble with the pleura or lung, but this is not significant as all of them are engaged in gainful occupations. These probably should be included in the list of those who recover, which would change the recoveries approximately to 64 per cent. Five of the patients listed as recovered had recurrence of pleurisy and recovered subsequently. Guinea pigs were inoculated with the pleural fluid from 92 patients. Thirteen of the tests were failures because of the untimely death of the guinea pigs from other causes. In 22 of the remaining 79 tests, necropsy of the guinea pigs revealed positive evidence of tuberculosis and negative evidence in 57. Nine of the 22 patients are dead, and 6 have tuberculosis elsewhere in the body. Twelve of the 57 patients are dead, and 14 have tuberculosis elsewhere in the body. In other words, of patients whose pleural fluid reacted negatively for tuberculosis in guinea pigs, a total of 56.1 per cent recovered, whereas of those whose pleural fluid reacted positively only 36.3 per cent recovered. An effort was made to determine how much influence rest played in the ultimate result. Of the 18 patients who died within the first year it is, of course, impossible to tell what influence the proper rest and regimen would have had, as they suffered recurrence or relapse before they recovered from the acute illness. Many of these patients returned to their homes as soon as they were able to travel and it seems logical to assume that the result might have been more favorable had they taken the prolonged rest which is always prescribed. Eleven of the remaining 17 patients who died after the first year had only two months of rest, including the acute illness, before they returned to

their normal activities. Ten of these died within the first four years from recurrence of pulmonary tuberculosis. Forty-three of the 68 who recovered had four months' rest or more. From the study of these cases, it is clear that idiopathic pleurisy with effusion should be treated as tuberculosis with a matter of months of rigid regimen, rest, and the methods usually applied in the treatment of tuberculosis. If this is done, rather than to allow the patient to return to work when he has recovered from the acute symptoms, the prognosis will be much more favorable.

THE TREND OF SUBARACHNOID BLOCK

Gaston Labat, who has had much to do with the greatly increased use of spinal and regional anesthesia in America, has contributed an article of unusual worth in the June, 1930, number of the *Surgical Clinics of North America*.

Although it was with grave concern that the Mayo Clinic granted permission to Labat to use spinal anesthesia in 1920, the method has now become a routine in hundreds of hospitals and its scope has extended into the fields of obstetrics and of diagnosis. Increased interest in the subject is indicated by the three papers published in the United States in 1921 as compared to 51 in 1928 and 55 in 1929.

"A drop of blood pressure is no longer considered a dangerous feature, since it expresses only the dilatation of the splanchnic blood vessels in terms of the peripheral arterial contraction. We know that it should cause no alarm if the correct technic has been used; that is to say, if a simple drug like neocaine has been dissolved in the patient's cerebrospinal fluid and injected with proper technic, and the patient placed in the Trendelenburg position immediately after the injection."

Labat states that if this technic is used, there is no need for ephedrine or any other hypertensive drug, but if a cardiac stimulant is desired, the following may be used half an hour before the anesthesia:

Caffeine.....	0.25 gm.
Sodium benzoate.....	0.30 gm.
Sparteïn sulphate.....	0.05 gm.
Strychnine sulphate.....	0.001 gm.
Distilled water (q. s.).....	2 c. c.

Fatalities caused by the injection of ephedrine are explained in brief summary as follows:

1. Larger center of low pressure (splanchnic depression) as compared to that of high pressure (cerebral and medullary pressure).
2. Defective splanchnic arteries which can be made to dilate under increased differential peripheral blood pressure.

3. Violent response of the vascular area unaffected by the anesthetic, with resulting closure of the capillaries.
4. Progressive increase in splanchnic dilatation.
5. Progressive impoverishment of the vital centers (respiratory and cardiac.)
6. Progressive anoxemia through lack of proper ventilation.
7. Respiratory and cardiac collapse in rapid sequence.

Labat believes that blood-pressure readings are of little importance during the anesthesia, since they do not indicate the general condition of the circulation but the extent of vasodilatation in the splanchnic area. Ephedrine can not raise the pressure in the splanchnic area, where it is most needed.

The wider the area of anesthesia desired, the greater is the necessity for diffusion of the anesthetic in the spinal fluid. The only practicable and safe method of bringing about diffusion is that of placing the patient in the Trendelenburg position immediately after the injection has been made and maintaining this position during and for at least three hours after the operation.

The essential elements of the Labat technic are:

(1) Anatomical puncture of the spine; (2) injection of neocaine-cerebrospinal fluid with barbotage; (3) immediate Trendelenburg position.

Where to puncture.—Any space between the twelfth dorsal and fourth lumbar spines, according to the extent of anesthesia desired.

How to puncture.—Follow the middle line; keep the bevel of the needle facing east or west of the middle line of the back.

What needle.—Medium gage. The Labat (80/11) nickeloid, unbreakable needle has been tested, improved, and used for the last 14 years with uniformly good results.

What anesthetic solution.—Neocaine crystals dissolved in cerebrospinal fluid, with which the author has had no death since its introduction in surgical practice in 1916.

What dose.—Adults, from 0.10 to 0.20 gm.; the dose of 0.12 and 0.15 gm. being sufficient in the great majority of cases. Children, from 0.03 to 0.10 gm.

Amount of fluid.—Always the capacity of the ampule (3 c. c.), whatever be the level of anesthesia desired, from the line of nipples to lower extremities.

Barbotage.—Always; reducing the quantity of new fluid aspirated and number of aspirations as lower punctures are made, in order to lower level of anesthesia.

Trendelenburg position.—Immediately after the needle and syringe have been pulled out of the back. Do not lose time in placing a dressing or a drop of collodion. We have never seen an infection at the site of puncture. Have the shoulder blades ready on the table. Precious time is too often lost in going after them.

When the operation has been completed see that the *horizontal position be not restored* and that the *elevator is ready*. Transfer patient on adjustable stretcher with head lower than pelvis. Improvise one with cushions if none is at hand. Raise foot of the bed on the seat of a chair if shock blocks are not handy at the time the patient is placed in bed. Maintain this position for three hours at least.

Cardiac stimulants.—If deemed fit, caffeine and strychnine may be given subcutaneously one-half hour before the induction of anesthesia. After the

operation one cup of hot black coffee taken by sips. In the presence of nausea, close nose with fingers used as clamps on the nostrils and force patient to take deep breaths through the mouth; apply cold sponges on neck. These are exceptional cases, but they need mentioning.

No ephedrine, epinephrine, or any other hypertensive drug before or during spinal anesthesia.

ETHYLENE OXIDE AND ETHYLENE DICHLORIDE, TWO NEW FUMIGANTS

The August, 1930, number of Industrial and Engineering Chemistry contains an article by J. M. Russ, jr., on two new fumigants against insects which are likely to prove of great use in the naval service. These new agents are ethylene dichloride and ethylene oxide. Both are highly toxic to insect life and relatively nontoxic to man.

Their desirability as fumigants was discovered by the Bureau of Entomology, and the Bureau of Soils, United States Department of Agriculture, in a search for chemicals that would be effective in the fumigation of grain in elevators and flour and meal in warehouses.

Ethylene dichloride is a colorless liquid with a specific gravity of 1.27. The vapors are approximately 3.5 times as heavy as air. It will burn, but it is rendered noninflammable by the addition of approximately 25 per cent of carbon tetrachloride. For commercial fumigation a dosage of 14 pounds per 1,000 cubic feet is recommended. This will kill, in 24 hours, clothes moths, cockroaches, and bedbugs. The mixture is placed in shallow pans and allowed to evaporate or, provided the walls or floor are unfinished, it may be used as a spray.

Ethylene oxide is a colorless liquid approximately 1.7 times as heavy as air. The vapors exhibit remarkable penetration into dense materials such as wheat flour and corn meal. Although the concentrated vapors are inflammable, the lower limit of inflammability is 3 per cent by volume or 3.67 pounds per 1,000 cubic feet. For commercial fumigation, 2 pounds per cubic foot is recommended. It has been found possible to mix liquid ethylene oxide and liquid carbon dioxide without reaction. This mixture is marketed under the trade name of "Carboxide."

Carboxide cylinders are equipped with eductor tubes for easy and rapid withdrawal of the fumigant. The mixture issues from the cylinder as a liquid which is atomized to a fine mist. Vaporization of the mist requires only a few minutes, thereby making available the maximum concentration of fumigant in a very short time.

Houses and apartments have been successfully fumigated with carboxide and the ethylene dichloride-carbon tetrachloride mixture. Separate rooms and apartments can be fumigated without vacating

other apartments in the same building. For this purpose carboxide is superior to the ethylene dichloride mixture. Storerooms in candy factories, hospitals, restaurants, storage warehouses, and grocery stores have been fumigated successfully with ethylene oxide and carbon dioxide. Insects in packages of cereals, dried fruits, and flour can be killed when the proper conditions are observed.

While ethylene oxide and carboxide and the ethylene dichloride mixture are not dangerously toxic to humans, overexposure to the concentrated vapors will cause severe nausea. For house, apartment, or any type of fumigation where the operator is liable to overexposure, it is advisable to wear a mask which will absorb organic vapors.

ASSISTANT SECRETARY SPEAKS ON NAVY MEDICAL DEPARTMENT

On September 29 the following address was delivered over the National Broadcasting Co. network by the Hon. Ernest Lee Jahncke, Assistant Secretary of the Navy:

In the few minutes at my disposal I am pleased to tell you of one feature of the Navy which no one has ever thought of reducing or limiting by treaty or otherwise.

This is the quality of the human element of the Navy. We have heard much of late of the material side of the Navy; much of ships, guns, bombs, and airplanes. More important is the personnel side; the power which operates; the force which makes the material of the Navy effective—the manpower. Only is the manpower productive and creative when it is viewed as a very healthy, very human element.

To tell you how the human part of this great machine is maintained always at the highest point of efficiency, I am obliged to speak principally of the scope of activities of that department of the naval service that is concerned with the health of the Navy personnel.

The Medical Department of the Navy is composed of about 900 medical officers, 200 dental officers, 500 female nurses, and 4,000 Hospital Corps men, or male nurses, pharmacists, laboratory technicians, and Medical Department property custodians.

Very few persons probably have any idea of the extremely wide range and unique diversity of duties performed by this organization. The work of the Medical Department begins at the recruiting offices where applicants for entrance into the Navy and Marine Corps are, so to speak, so carefully gone over with a fine-toothed comb that only about 16 per cent of them are accepted as meeting the present rigid standards of physical and mental fitness required by Navy regulations.

Not the least part of the work at the recruiting office is the investigation of the applicant's character and mentality. Formerly we

were only interested in the physical status of the recruit, and many perfect physical specimens were accepted who could not possibly fit into navy life because of their mental and moral delinquencies and their basic unfitness to comprehend a complex, specialized profession.

Many such boys who were only about two jumps ahead of the sheriff formerly rushed into the Navy as a haven of escape and were even encouraged to do this by judges, relatives, and other persons. They soon found that their type had an even harder time getting along in the Navy than in civil life. Now all this class is rejected at the door to the Navy by the methods of investigation in use at recruiting offices. All this, of course, makes for greater efficiency in the work of the Navy, and results also in a much more pleasant and wholesome environment for everyone in the service. From the moment a man enters the Navy his health and life are guarded in every conceivable way. This is not only a question of humanity—it is one of economy and efficiency. The men are every day performing hazardous duties; they are working with highly technical, dangerous, and expensive machinery; they are assuming jobs of great responsibility. Any one of them who is not right up to the mark of physical fitness may thus be a potential danger to many of his shipmates and to the effectiveness of the mission of the Navy.

When the recruit arrives at the training camp he first goes through a period of quarantine. Here, by means of vaccination, he is protected against certain diseases for the term of his enlistment. Here he is carefully observed in order to make certain that he is harboring no communicable disease that might spread to others. Here he is rendered dentally fit at the outset of his service career. If he falls sick at these training camps or at other shore stations, he is immediately sent to the local naval hospital, where he receives the advantages of the most modern and complete hospital equipment and every attention from a group of highly trained specialists of the Medical Corps.

Wherever he goes in the Navy his health is promoted and guarded by the carefully studied regulation of many details of his daily life, such as those of diet, clothing, exercise, recreation, and rest.

Sanitary measures of a hundred sorts are always in operation wherever Navy activities exist, including—just to mention a few—such considerations as ventilation, lighting, heating, pure water supply, protection from disease-carrying insects in tropics, protection from dangerous machinery by special safeguards; being a specially selected individual his health is guarded zealously. The Navy must be a healthy, vigorous organization.

If he falls ill while at sea he receives practically the same care that he would in one of the 15 naval hospitals, for the ships all carry

Medical Department personnel and all but the smallest ones are admirably equipped with the necessary facilities for the care of the sick and injured. Also, we have a wonderful hospital ship, the U. S. S. *Relief*, which is a veritable floating hospital, modern in every sense, and which accompanies the fleet, receiving patients whose particular cases may demand specialized hospital care. In our hospitals ashore we not only care for the Navy sick and injured, but 3,000 war veterans irrespective of original service, whether Army, Navy, Marine Corps, or Coast Guard.

If a man decides to go into aviation in the Navy, he can only do so by passing the most rigid kind of physical examination. He can only remain on a flying status as long as he continues to meet high physical standards. Such a policy is the result of long years of study conducted by men in a newly developed specialty known as aviation medicine. This policy has doubtless had much to do with the Navy's very enviable record of reduction in aviation casualties. Although it now trains about 500 student aviators a year and this training involves very hazardous types of flying, such as formation flying, combat maneuvers, some stunt flying, and landing on ships' decks, fatalities have been reduced to about one-tenth the rate that existed a few years ago, the rate being now one fatality to 10,000 flying hours. No such record could be attained if flyers were not kept physically and mentally fit.

You marvel at the submarine. It is solely a naval instrument. As a vessel especially designed for duty under the water, human beings aboard a submarine live, work, and fight in a confined space—one sealed off from external communication.

Our largest submarine carries a crew of 7 officers and 80 men. The naval medical officer contributes immeasurably with his scientific knowledge and patient research to the conversion of uninhabitable spaces poisoned by human waste and noxious mechanical gases into healthy, hygienic quarters under great sea pressures. The naval medical officer is an effective force in the progress being made toward submarine advances.

Deep-sea diving is hazardous work. Our modern knowledge of the physiology of living under increased pressure has developed improved safeguards and created new methods of treating diseases resulting therefrom.

The frequent contacts of Navy ships with foreign ports the world over, where health conditions are dangerous, occasions strict vigilance on the part of the Navy Medical Department, not only to protect its own personnel but civilian communities in the United States as well. Besides the foreign contacts of Navy ships, our Marine Corps forces, which organization is a part of the Navy, land and live on foreign soil, particularly in tropical regions, in intimate association

with native diseased populaces. Wherever the marines go, representatives of the Medical Department go likewise, be it on land or sea, in jungle waste, or on battle line. During the World War the forces of the Medical Department were, of course, with the marines in the trenches and on open battlefield, suffering their share of hardships and casualties while engaged in rescuing and treating the wounded and evacuating them to places of safety.

For the recent war period, the percentage of medical personnel killed was nearly twice as great as the percentage loss for the combined other classes of Navy personnel. The percentage wounded was five times as great for medical personnel as for all other branches of the Navy.

The congressional medal of honor is the highest military decoration conferred by our Government for extraordinary heroism in the face of the enemy. A total of 11 of these medals were awarded to persons in the Navy during the late war. Of this total 6, or more than 50 per cent, were awarded to members of the Navy Medical Department. The heroic, self-sacrificing, unassuming service of the naval doctor and hospital corpsman in war stands resplendently as one of the most inspiring pages in history.

In order to train medical officers for their manifold and diverse duties and to acquaint them with the Navy system of reports and records by means of which the Bureau of Medicine and Surgery keeps in constant touch with every detail of health conditions at all Navy activities, a Navy Medical School has been functioning at Washington since 1902.

One of its important functions is the teaching of tropical medicine. It happens that this school was the pioneer institution in America in the systematic teaching of this subject. Some of the foremost advances in medical science are of naval origin.

In addition to the Navy Medical School, the Medical Department conducts two other schools for the training of Hospital Corps men at Norfolk and San Diego. About 5 per cent of the 4,000 Hospital Corps men are constantly in attendance at one of these schools. Many of them also attend special courses at the Navy Medical School.

In addition to instruction in their routine hospital duties, they pursue special courses in such subjects as chemistry, bacteriology, laboratory technique, X ray technique, and training as dental assistants.

I feel that the peace-time Navy is contributing something of great value to civilian communities when the young men of the Hospital Corps complete their enlistments and return to these communities equipped with all this special training. Large numbers of former Hospital Corps men are now filling positions of responsibility in civilian laboratories, hospitals, and pharmaceutical companies.

Lastly, I want to say a word about a phase of the Medical Department's work which reaches quite beyond the sphere of caring for service personnel. This is the work that has been accomplished in our island possessions and in other countries where our military occupation exists by reason of treaty agreements. In all these countries the United States has brought enormous benefits to the natives through the sanitation and the hospital service supplied by the Medical Corps.

In each case the task has been gigantic—the result brilliant. The greatest of these achievements has been accomplished in Haiti. No other aspect of our presence in these islands has gone so far in promoting cordial and friendly relations with the natives, and no other feature has been so whole-heartedly appreciated by them. Naval medical officials and medical and surgical supplies were rushed by airplane to Santo Domingo when that country was swept by the recent hurricane. One naval surgeon performed 50 amputations, besides other operations on native injured, in one day. The Navy Medical Corps is constantly prepared to meet emergencies the world over.

The naval Medical Department, at home and abroad, aboard ship, in foreign lands, in the air, under the sea, in hospital, in tropical camp, on battle line, contributes a service to country and to humanity far above appraisal, and one which shines gloriously as a hopeful light to more perfect manhood and better human understanding.

THE NATIONAL INSTITUTE OF HEALTH

(Successor to the Hygienic Laboratory)

By the act of Congress approved May 26, 1930, entitled "An act to establish and operate a National Institute of Health, to create a system of fellowships in said institute, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, and for other purposes," the Hygienic Laboratory will hereafter be known as the National Institute of Health of the United States Public Health Service. The author of this measure was Senator Joseph E. Ransdell, of Louisiana.

The general purposes of the act are to provide large facilities for investigations of diseases of man and matters pertaining to the public health, to encourage research and the training of individuals engaged therein, to enable the Government to accept bequests in aid thereof, and to bring about cooperation with scientific institutions in the prosecution of research work.

Public health investigations by the Public Health Service were first authorized in 1901. Since then substantial progress has been made and many new facts have been discovered which have had an important bearing on the prevention and control of disease. The necessity for this work far outstripped the facilities for its conduct. Under

the above-mentioned authority these facilities may be greatly enlarged.

In its development the new institute will have the advantage of the traditions of the Hygienic Laboratory. In reality the Hygienic Laboratory becomes the National Institute of Health which, with enlarged facilities, will be devoted to investigations of the underlying problems not only of communicable diseases but of degenerative diseases and environmental conditions affecting health.

In aid of this work the Secretary of the Treasury may hereafter accept gifts to be held in trust and used for the purposes mentioned; the expenditures to be safeguarded in all respects as are other governmental funds. These gifts may also be used for the establishment of fellowships to encourage individual scientists. Appointments and services under these fellowships will be governed by laws and regulations affecting the United States Public Health Service. Individual ability is the most valuable asset of a people of a country. The object is to encourage postgraduates of extraordinary ability and to aid them to follow permanently their scientific bent in the interests of humanity.

In order that those who make gifts may have a living part in the development of the institute, provision is made whereby donations of \$500,000 or over will be acknowledged permanently by the establishment within the institute of suitable memorials.

The Secretary of the Treasury has recently accepted a gift of \$100,000 offered by the Chemical Foundation, Inc., through its president, Mr. Francis P. Garvan, under the provisions of the act of May 26, 1930, which authorizes the Government to accept donations and to create a system of fellowships, etc., in the National Institute of Health. The condition is made that the income from this fund be used for one or more fellowships in basic chemical research in matters pertaining to public health, the details of which are left to the Surgeon General and his advisory committee. The act provides that conditional gifts such as this may be accepted by the Secretary of the Treasury if recommended by the Surgeon General and the National Advisory Health Council.

NEW BUREAU PUBLICATIONS

The new Nomenclature of Diseases and Injuries will be distributed to the service about January 1, and the new Supply Tables about February 1, 1931.

The Nomenclature of Diseases and Injuries, which in 1926 was a partial reprint of chapter 15 of the Manual of the Medical Department, 1922, has been revised and brought up to date.

One of the important changes made in the nomenclature is the inclusion of the "Nomenclature of Causes of Injury" which has been amplified by the addition of approximately 200 titles.

Two key letters were added: "N"—"Traumatism due to violence by assault without deadly weapons, fighting, maintaining order, resisting arrest, and skylarking"; "O"—"Traumatism by railroads, railways, vehicles, etc. To include all traumatism, burns, and falls caused by railroads (electric and steam), electric railways, vehicles (automobiles, motor cycle, motor truck, tractor, bicycle, carriage, and wagon); earthquakes, landslides, and other unclassifiable crushing."

The following are a few of the new titles added: Gonococcus infection epididymis (1209); prostate (1210); and seminal vesicles (1211); serum sickness (2165); the type of malaria—benign tertian, malignant tertian, and quartan. Under trichophytosis (2240) the location will be specified. The title "Verruca Accuminata" was subdivided to show a venereal and a nonvenereal distinction by the addition of diagnosis number 1209 (*Verruca accuminata*, venereal). Vincent's infection (oral) (2714) was added to report those conditions which primarily involve the gums.

Under the arrangement of diseases by classes, the diagnosis number has been placed before each diagnosis to facilitate the identification of the diagnosis when reference is made by diagnosis number.

The above changes will go into effect as of January 1, 1931.

The new features of the supply table are:

1. Titles in bold-face type. Subtitles in italics.
2. Poisons in bold-face type to conform to standard pharmaceutical practice.
3. Instruments and appliances in the general list have subletters to indicate if they are found in special outfits.
4. Diagnostic case in place of old diagnostic roll.
5. Local anesthesia set added.
6. Surgical outfit for destroyer leaders to better enable the division medical officer to handle emergency surgery.
7. New type of surgical cabinet. Empty drawers with empty canvas rolls for instruments for each drawer. 7-056.
8. 7-057. Old cabinet has been left on until supply is exhausted.
9. General revision of X ray and dental supplies. Addition of electrocardiographic supplies.
10. Some new drugs, as ephedrin and insulin, have been added.
11. General instruction as to preparation of requisitions revised. Precautionary note as to poisons and deterioration of drugs added.
12. Basic allowance table showing the original allowance of special outfits for each type of ship.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review.)

A CENTURY WITH THE NORFOLK NAVAL HOSPITAL, 1830-1930. A STORY OF THE OLDEST NAVAL HOSPITAL, THE MEDICAL DEPARTMENT OF THE NAVY, AND THE PROGRESS OF MEDICINE THROUGH THE PAST 100 YEARS, by Richmond C. Holcomb, M. D., F. A. C. S., Captain, Medical Corps, United States Navy. Printcraft Publishing Co., Portsmouth, Va., 1930.

Captain Holcomb has completed in this book an exceedingly long job; also a very, very wide one. The long subtitle, suggesting as it does the diverse trails of history along which the reader will be led, is only a hint at the number and diversity and size of the subjects covered. And, yet, however winding the paths, however far we wander along any of them, the author manages always to make them lead eventually back to the Norfolk hospital.

This reviewer had misgivings at many points in the journey; he even lost hope of ever seeing the hospital again, but after seeing some of the places the author came through, always spiraling down to a perfect landing on the deck of the hospital, he, the reviewer, was convinced that all roads lead to Norfolk as well as to Rome.

The saving word in the title is the preposition "with." If the author had been less skillful and had used any other preposition, the title would have been misleading. The Norfolk hospital went through a hundred years *with* the Navy Medical Department and *with* the history of medicine. There were other elements in that great march. There were the history of the United States, naval history, the history of individuals who played prominent rôles in the story; there were all sorts of things and places, and schools of thought, and events that went along *with* the procession. They are all related to the story—a pretty distant relationship in some instances, but the relationship is there, and the author makes us see it.

No one can possibly fail to have his understanding and vision of the present Navy and present Navy Medical Department and present

status of medicine broadened and deepened by a more intimate knowledge of the background of these matters. And I don't know of any two book covers between which he might find such a large and complete and authentic mass of information in a form that combines in a readable tale these particular aspects of our history. No naval medical officer can possibly fail to find in Captain Holcomb's book an education that will increase very substantially his understanding of the rather special world in which he lives and works. If it is important that American school children know something about Washington and Lincoln and the high spots of American history, it is important that medical officers know something about the founders of our Medical Department and the high spots of its history. Knowing its struggles and its weaknesses of the past will help in steering it through its future struggles and in repairing and fortifying its present weak areas.

As to the pattern of the book, the story begins in 1636, the first chapter leading us to 1830, with a discussion of the status of land titles in that period. There is a good deal of incidental material here on the early history of America and Virginia and Norfolk, the history of tobacco as a medium of exchange, and the history of the 80-acre plot which was acquired in 1830 and on which the hospital now stands.

Chapter II, entitled "Old Fort Nelson, 1774-1827," includes some information on the drinking customs of the period, some Revolution history as it affected Norfolk, some more Norfolk history, and an account of Fort Nelson (on the site of which the hospital was built).

Chapter III, The Medical Corps, U. S. Navy, 1775-1830, contains much that should interest naval medical officers, possibly others. There is a splendid account of early customs, conditions, traditions in the corps, the part its members played in the Revolution, in the wars with the Barbary States, and in the war of 1812. Here, as in most of the chapters, there is much written on American naval history, and numerous and interesting side lights on the history of American medicine of the period. There is some excellent biographical material on such men as Barton, Heerman, Ridgely, Cowdery, and Usher Parsons. Of particular historical value and interest in this chapter is a list of 34 naval medical officers who served in the war of 1812 and who were mentioned in resolutions of Congress.

Chapter IV, The Naval Hospital Fund, takes us through much information on this subject and numerous other related subjects, some not so closely related.

Chapter V tells us about the famous Philadelphia architect, John Haviland, and how he built the first naval hospital. Chapter VI

is an account of the commissioning of the hospital and its administration in the thirties. Chapters VII and VIII take us to 1861, with an account of certain improvements and additions to the hospital and grounds, some history of medicine, and an excellent account of the establishment of the Bureau of Medicine and Surgery. There is a section on the Mexican War and some very interesting biographical material on three medical officers of the period—C. D. Maxwell, Elisha Kent Kane, and William Maxwell Wood.

The chapter on The Yellow Fever Epidemic of 1855 contains many side lights on the history of yellow fever, together with an illuminating and detailed account of this particular epidemic and of the heroic work of the Norfolk Naval Hospital during the epidemic.

Chapter X has to do with the Civil War period and the period up to the Spanish-American War. This includes a variety of historical aspects—naval, medical, biographical, Norfolkian.

A chapter entitled "Through the Spanish War, 1898-1907" contains much about the condition of the Medical Corps of the period, some hospital-ship history, an account of the establishment of the Hospital Corps, a considerable bit of naval history, and much about the Norfolk hospital, with an engaging description of the oyster-shell roads through the hospital grounds. In this chapter there appears another section of the history of yellow fever, this including an account of Walter Reed's epochal experiments in Cuba.

The remaining chapters (Remodeling the Structure, 1907-1917; Through the Great War, 1909-1929; The Burying Ground, 1830-1928; The Hospital Corps School; At the Eve of 100 Years, 1930; To Them Who Build) are limited more strictly to matters of the Navy Medical Department and of the Norfolk hospital. This includes some splendid discussion on hospital ships, a discussion of research work performed by naval medical officers, an authentic and quite comprehensive record of Medical Department activities during the late war, and an account of the development of the program of hospitalization of Veterans' Bureau patients in naval hospitals.

Those interested in the subject of Hospital Corps training will find much information in Captain Holcomb's account of the development of the Hospital Corps School.

The final chapter includes some appealing philosophic musings on the subject of the Navy Medical Department and matters pertaining thereto.

Not the least important feature of the book is the well-chosen collection of 42 illustrations. These include several interesting old prints, photographs, and maps.

All in all, this is a very fine book, both for entertaining reading and as a reliable reference. It is a book that any intelligent person

could read with enjoyment and a book that every medical officer should read with profit.

MILITARY PREVENTIVE MEDICINE, by *George C. Dunham, M. A., M. D., Dr. P. H., D. T. M. and H. Major Medical Corps, U. S. Army, Director, Department of Sanitation, Medical Field Service School. Medical Field Service School, Carlisle Barracks, Pa., 1930.*

This book represents a compilation of the work of the department of sanitation of the Medical Field Service School at Carlisle Barracks, Pa., and as such may be considered the latest and most authoritative book on field hygiene published. The work is distinguished by the clearness and completeness of the information given on each subject, and both of these features are enhanced by the large clear type used in printing the book and the number of excellent pictures. Of particular value to naval medical officers, who may at any time be called upon to serve with Marine Corps expeditionary forces, are the emphasis placed upon field sanitation as an administrative problem, the fine description of water purification in the field, and the disposal of sewage and kitchen wastes in camp and on the march. The measures for the control of important diseases are so carefully and completely given as to make these sections valuable reference texts. Another special feature is the extensive section devoted to food standards and food inspections. Eighty-two pages are devoted to milk and dairy products alone, and included are a model milk ordinance and model score cards for the inspection of dairy plants and products.

NERVOUS INDIGESTION, by *Walter C. Alvarez, M. D., Associate Professor of Medicine, University of Minnesota (The Mayo Foundation). Paul B. Hoeber, New York, 1930. Price, \$3.75.*

If there existed a system of ratings for medical books and if there was some way of casting a vote, this reviewer would rate Alvarez's new book in class A1 and would vote it as being one of the year's finest and most valuable contributions to the literature that is presumed to be of aid in the practice of medicine.

Several considerations brought about this decision. In the first place, we have great need for such a book. It enlightens us on problems which we must meet every day, but on which little has been written and about which our knowledge is decidedly meager. Next, it is written by an authority whose standing in the front rank of those concerned with the scientific and academic aspects of gastroenterology has not made him lose the common touch, the all important common sense elements of the practice of this specialty. His penetration in this respect is a feature that is always desired but rarely encountered. Next, the book is downright readable. It is scholarly without being pedantic. Alvarez is a writer of high skill, one of those unusual medical writers who can put fine literary polish to a scientific discus-

sion and can inject entertainment as well as information into his pages. His regard for the art of stating a matter choicely as well as precisely is made more obvious by his nice selection of numerous quotations from the classics where this art reaches a high level. These quotations are scattered throughout the book, and the last chapter is entirely devoted to running comments and brief abstracts from the writings of William Osler, Charles Darwin, O. W. Holmes, Richard Cabot, S. Weir Mitchell, John Brown, Francis W. Peabody, William Falconer, Clifford W. Beers, Jane Hillyer, H. A. Overstreet, H. C. King, J. B. Nichols, D. H. Tuke, Hippocrates, and R. L. Stevenson.

The titles of the other chapters are: Ways in Which Emotion Can Affect the Digestive Tract; Types of Indigestion; Hints in Regard to the Taking of a History; The Handling of the Nervous Patient; The Treatment of Nervous Indigestion; Some Practical Points About the Physiology and Innervation of the Digestive Tract.

A TEXTBOOK OF MEDICINE, by American authors. Edited by *Russell L. Cecil, A. B., M. D., Sc. D., Assistant Professor of Clinical Medicine in Cornell University; Assistant Visiting Physician to Bellevue Hospital, New York City.* Second Edition. W. B. Saunders Co., Philadelphia, 1930.

The 135 contributors to this widely acclaimed textbook of medicine make up a formidable array of the highest authorities in their several special branches of internal medicine. "Internal medicine" is not quite the term either, as this book covers practically everything in medicine, except the surgical subjects.

The death of five of the contributors since the appearance of the previous edition has made some changes in the list. The chapters on Yaws (by Nichols), Yellow Fever (by Noguchi), Diseases of Pleura (by Phillips), and Diphtheria (by Zingher) in the previous edition are, because of the deaths of these men, now written, respectively, by R. P. Strong, H. R. Muller, E. E. Irons, and W. H. Park.

New chapters have been added, among which may be mentioned that on Tularemia (by E. B. Francis), that on essential hypertension (by Malcolm Goodridge), and that on Arthritis (by the editor).

Doctor Strong's views on the etiology of yaws are mildly conservative and, in view of the most recent work, rational.

To quote Strong, in part:

However, perhaps the most conservative view in this respect is to the effect that we have in yaws a modified virus of syphilis—a less virulent one, producing a disease which has been modified by many years of successive passage of the virus through the epidermis of black-skinned races, by the habits of life of these people, and by the climate and hygienic conditions under which they live.

The chapters on beriberi and pellagara are by Douglas Vanderhoof. It is unfortunate that he has expressed some of Goldberger's earlier conclusions which, although correct enough, as far as they went, were not nearly so specific as his later writings on the food factors involved, and it is regrettable that Vanderhoof has not included these later findings.

ARTERIAL HYPERTENSION, by *Edward J. Stieglitz, M. S., M. D., Assistant Clinical Professor of Medicine, Rush Medical College, University of Chicago; Attending Internist, Chicago Lying-in Hospital; Assistant Attending Physician, Presbyterian Hospital.* Paul B. Hoeber, New York, 1930. Price, \$5.50.

There are more deaths to-day from the cardiovascular renal diseases than are caused by any other single pathological condition; therefore, a thorough understanding of the factors underlying this group of diseases is essential to all practitioners of medicine. Such an understanding may be gained from a study of Doctor Stieglitz's work. The importance of early diagnosis is forcefully presented, and rational methods of treatment are given. In addition, an extensive bibliography is appended for the benefit of those who wish to pursue their study of this important subject to greater lengths.

This book is highly recommended for the student and for the practicing physician.

A SYSTEM OF CLINICAL MEDICINE, by *Thomas Dixon Savill, M. D. (Lond.).* Eighth Edition. William Wood & Co., New York, 1930. Price, \$10.

This splendid system of clinical medicine is somewhat better suited for teaching than as a reference. It differs from most of the current texts in that it approaches the diseases from the standpoint of symptomatology.

The introductory chapter, in which Doctor Davill explains his methods, is reproduced unaltered in this as in all previous editions.

The book has grown to 1,000 pages and now has many contributors and collaborators, all of whom rank high in the British profession.

DIET IN DISEASE, by *George A. Harrop, Jr., M. D., Associate Professor of Medicine, Johns Hopkins University; Associate Physician, Johns Hopkins Hospital.* P. Blakiston's Son & Co., Philadelphia, 1930.

Amid the annual flood of books on diet, most of which are written for the laity or for nurses, and many of which are elementary in character and contain not all that one might desire in the way of authority, there emerge a book or two that is written for the physician, that comes from the highest sources, and presupposes some understanding of the principles of nutrition.

Of recent issue in this latter small class may be mentioned the fourth edition of *The Newer Knowledge of Nutrition*, by McCollum and Simonds (MacMillan), and this book by Harrop.

One weakness of the stock therapeutic diet list is that it encourages a routine use of a given diet for a given disease regardless of the particular needs of the individual patient. This may cause harm by producing food-deficiency disorders. This book attempts to teach the principles of nutrition in their relation to the practice of medicine, so that the physician may use these principles to formulate his own dietary treatment.

There is a brief account of the principal foodstuffs and their place in the diet. There are tables of food values of certain foods about which a working knowledge is of importance, together with the essential information regarding the preparation of these foods. The tables are taken largely from the Department of Agriculture's bulletin, *The Chemical Composition of American Food Materials*.

Most of the diet lists given have been thoroughly tested by use in the wards of the Johns Hopkins Hospital.

The book is divided into three parts:

I. The Requirements of Nutrition (energy, protein, mineral and fluid, and vitamin requirements).

II. The Elements of the Diet (information, particularly of practical and clinical importance, concerning the various classes of foods).

III. Dietary Treatment of Disease (15 chapters on the conditions in which dietary treatment is especially indicated).

There is an appendix of tables, recipes, and other matters of reference value.

HYPERTENSION: HIGH BLOOD PRESSURE AS A PRIMARY DISORDER OF VASO-MOTOR FUNCTION, by *Leslie T. Gager, Clinical Professor of Medicine, George Washington University*. Williams & Wilkins Co., Baltimore, 1930. Price, \$3.

A monograph of 126 pages, supplemented by a selected bibliography, which gives the prevailing medical opinions of etiology, symptoms, prognosis, and treatment of high blood pressure as a primary condition. The chapter on clinical study gives histories for comparison with one's personal observations. The importance of the retinal changes in diagnosis and prognosis is emphasized. The chapter on prognosis shows that the practicing physician and the life-insurance medical adviser must view high blood pressure differently. The life-insurance company must take into account the fact that, as a class, persons with hypertension have a high death rate, while the clinician can predict that most mild cases will live for many years and some few very severe cases for unexpectedly long periods. The short statistical tables given illustrate only too clearly the seriousness of even moderate hypertension, if persistent, and the rapidly rising extra mortality with each 10 mm. elevation, especially when the diastolic pressure is high.

In treatment, the well-known methods are compared. The oral administration of aqueous solution of potassium sulphocyanate is especially lauded.

Study of this book by those medical officers making the annual physical examinations would help correlate their ideas of this commonly met defect. As a result, more rational advice and early treatment would be given and the conflicting evidence of life-insurance rejections with a favorable prognosis explained. Severe cases could be headed for the retired list earlier in order to conserve their diminished life expectancy. The frequency and seriousness of hypertension beginning in early adult life should impress those medical officers on recruiting duty with the necessity of being alert to exclude such persons from the naval service, especially when examining prospective candidates for the Naval Academy or for commissions.

PERNICIOUS ANÆMIA, by *Leybourne Stanley Patrick Davidson, B. A. (Camb.), M. D., F. R. C. P. E.*; *Lecturer in Systematic and in Clinical Medicine in the University of Edinburgh; Assistant Physician to the Royal Infirmary, Edinburgh; Formerly Assistant Physician to Leith Hospital; Assistant to the Professor of Bacteriology, University of Edinburgh; and George Lovell Gulland, C. M. G., LL. D., M. D., F. R. C. P. E.*; *Professor Emeritus of Medicine and Clinical Medicine in the University of Edinburgh; Consulting Physician to the Royal Infirmary, Edinburgh.* The C. V. Mosby Co., St. Louis, 1930.

An advancement in medicine which stays the ravages of a hitherto fatal disease renews the interest of the practitioner and brings it prominently to the attention of the laity. This is true of pernicious anæmia to-day.

In this volume the authors have brought together the vast literature on pernicious anæmia and correlated it for the reader in a most complete and up-to-date discussion of the subject. Blood findings including the pernicious anæmia neutrophiles are well illustrated by several full-page plates, some of which are in colors. An extensive appendix on dietetic treatment by Ruth Pybus, dietitian of the Royal Infirmary, Edinburgh, includes numerous liver recipes which should be of great aid in relieving the monotony of the liver diet. A copious bibliography completes an excellent book.

GONOCOCCAL INFECTION IN THE MALE, by *A. L. Wolbarst, M. D., Urologist and Director of Urologic Clinics, Beth Israel Hospital; Consulting Urologist, Central Islip State Hospital, Manhattan State Hospital, Jewish Memorial Hospital, and Madison Park Hospital.* Second Edition. The C. V. Mosby Co., St. Louis, 1930. Price, \$5.50.

With some 9,000 admissions per year in the Navy for gonococcus infections, this resulting in an admission rate of about 75 per 1,000

men per year for the disease and causing more than 100,000 sick days per year, the importance of gonorrhea in the Navy is such that the disease constitutes one of the largest and most serious problems in naval medicine.

Skillfully written books on the subject by authors who are recognized authorities are, therefore, always received with considerable welcome by the Navy medical officer.

Those who are anxious to keep informed on all the advances in our knowledge of this disease will not find excessive the addition to their shelves of one good book per year on the subject. Pelouze's book in 1928 formed a splendid guide and achieved much well merited popularity. Since 1928 this book of Wolbarst's is the most valuable contribution to the texts that we have seen.

The author has placed special emphasis on the concept that gonorrhea is a constitutional disease which can be cured only by the inherent reparative forces of the individual.

A particularly fine feature of the book is the discussion (illustrated by numerous urethroscopic pictures) of lesions of the verumontanum and posterior urethra.

The book throughout is written with the view of bringing sound practical advice to those who are engaged in treating gonorrhea in the male.

BURNS, TYPES, PATHOLOGY, AND MANAGEMENT, by *George T. Pack, B. S., M. D., Fellow of the Memorial Hospital, New York City; Formerly Professor of Pathology and Lecturer in Minor Surgery, The School of Medicine, University of Alabama, etc., and A. Hobson Davis, B. S., M. D., Instructor in Pathology, University of Alabama.* J. B. Lippincott Co., Philadelphia, 1930.

One human inclination that must be listed as a human virtue is the desire to grasp all the available knowledge on some particular subject. When the subject lies in some field of medicine this tendency to hobby formation works to the advantage of many persons, and is often actuated by the most laudable motives. Thus Doctors Pack and Davis were led by their sympathy for sufferers from burns and their own general helplessness in relieving them, to pursue this intensive study of the subject.

They have written an admirable monograph that should serve as a most valuable aid to those who undertake to treat burns and scalds.

The first 11 chapters are devoted to the fundamental facts concerning burns and scalds. The next 12 chapters deal with the management of the cases. In the last six chapters the authors discuss certain regional burns and burns of specific agents.

A TREATISE ON ORTHOPAEDIC SURGERY, by *Royal Whitman, M. D., M. R. C. S., F. A. C. S., Consultant to the Hospital for the Ruptured and Crippled, to the St. Giles and St. John's Guild Hospitals, to the New York and Darrach Homes for Crippled Children, etc.* Ninth edition. Lea & Febiger, Philadelphia, 1930. Price, \$10.

A masterful treatise, covering most comprehensively all departments of the subject, profusely and excellently illustrated. An invaluable text for those engaged either daily or occasionally in orthopedic work.

The subject has been presented as far as practicable from a functional standpoint and in a manner that has proved acceptable in clinical teaching. Thus, mindful that the majority of the deforming diseases are first cared for by the general practitioner, the writer has been at some pains to demonstrate methods of systematic physical examination that lead to early diagnosis and so to explain the relation of causes to consequences as to indicate in natural sequence the principles of preventive treatment.

This ninth edition has been thoroughly revised and by comparison with the first, which appeared in 1901, demonstrates clearly the great advance, both in scope and method of this branch of surgery during the present century.

ROSE AND CARLESS' MANUAL OF SURGERY, by *Cecil P. G. Wakeley, F. R. C. S. (Eng.), F. R. S. (Edin.), Erasmus Wilson Lecturer, Royal College of Surgeons of England, etc., and John B. Hunter, M. C., M. Chir. Cantab., F. R. C. S. (Eng.), Assistant Surgeon, King's College Hospital, etc.* Thirteenth Edition. William Wood & Co., New York, 1930. Price, \$11.

This new edition of Rose and Carless is larger than ever. It is so well known to readers of surgical texts that no comment is necessary beyond the mention of the appearance of the 1930 edition. The book has about reached the point beyond which any further increase in size will require its being split into two or more volumes. It is now probably the most complete single volume treatise on surgery.

A TEXTBOOK OF GYNECOLOGY, by *Arthur Hale Curtis, M. D., Professor and Head of the Department of Obstetrics and Gynecology, Northwestern University Medical School.* W. B. Saunders Co., Philadelphia, 1930.

Did space permit, much might be said in praise of Curtis' gynecology. He has succeeded in putting together a complete text on less than 400 pages. There are 222 original illustrations, all of the highest order. The presentation is almost entirely independent, being based essentially on the author's experience.

MINOR SURGERY AND BANDAGING, by *Gwynne Williams, M. S., F. R. C. S., Surgeon, University College Hospital.* Twentieth Edition. F. A. Davis, Philadelphia, 1930. Price, \$3.50.

A pocket-sized compend on a variety of subjects—mostly those of minor surgery and bandaging. It might be of use to the pharmacist's mate on independent duty.

TROPICAL MEDICINE IN THE UNITED STATES, by *Alfred C. Reed, M. D., Professor of Tropical Medicine, the Pacific Institute of Tropical Medicine, within the George Williams Hooper Foundation for Medical Research of the University of California.* J. B. Lippincott Co., Philadelphia, 1930.

This book, as stated in the preface, is intended for use of the practitioner in the United States. Those tropical diseases endemic in this country or occasionally brought in are discussed. Historical data is not included. Epidemiology is given a limited space. Parasitology is practically omitted. The volume thus becomes a clinical handbook.

Medical officers in the naval service and those physicians who practice in tropical countries will require more epidemiological information and more detailed parasitology than are included.

EIGHTEENTH ANNUAL REPORT, MEDICAL DEPARTMENT, UNITED FRUIT COMPANY, 1929.

The articles on malaria are especially interesting. The value of plasmochin in treating crescent carriers is confirmed by all those using this drug. The blood studies in blackwater fever, by Dr. Eugene R. Whitmore, show that kidney damage with nitrogen retention is of great importance in that disease. The problem and significance of malaria in children in endemic areas is discussed by Dr. H. C. Clark. Malaria and other blood parasites of wild monkeys of Panama are described and the possibility of certain monkeys being naturally infected with human malaria is suggested by Doctor Clark as worth further investigation.

A case of filarial infestation with loa loa acquired in Africa but diagnosed in Panama is reported by Dr. I. E. Peon.

A natural infection of an opossum, in Honduras, with a trypanosome apparently identical with *Schizotrypanum cruzi* leads to speculation as to the possibility of human cases in all of Central America.

Pictures and descriptions are given of poisonous snakes in Honduras. Case histories of all snake bites for 1929 are reported showing the relative infrequency of a fatal termination.

Renal anomalies noted in 4,215 consecutive autopsies are reported by Dr. H. C. Clark.

Other articles dealing with diseases of tropical medicine, general medicine, obstetrics, and general surgery make this a very valuable publication.

AN INTRODUCTION TO MALARIOLOGY, by *Mark F. Boyd*, Harvard University Press, Cambridge, Mass., 1930. Price, \$5.

This book is of particular value and importance to naval medical officers. There are usually more than 1,000 men per year admitted to the Navy sick list with malaria, and the cost in time averages about 40,000 sick days per year.

Those on duty in malarious regions will find in this comprehensive treatise an excellent aid to their efforts in malaria control. The book gives information on the phenomena of the epidemiology of malaria and introduces the epidemiologist or public health official to methods for the investigation and analysis of malaria problems as a necessary preliminary to malaria control activities.

THE PRINCIPLES AND PRACTICE OF HYGIENE, by *Dean Franklin Smiley, A. B., M. D., Medical Adviser and Professor of Hygiene in Cornell University*, and *Adrian Gordon Gould, Ph. B., M. D., Assistant Medical Adviser and Assistant Professor of Hygiene in Cornell University*, and *Elizabeth Melby, M. A. (Columbia), R. N., Assistant Professor, Yale University School of Nursing*. The Macmillan Co., New York, 1930.

Although written primarily for the instruction of nurses, this excellent and authoritative book covers the field so comprehensively and in such an admirably practical way that it could be the source of much enlightenment to a large number of the medical profession and a larger number of the more intelligent circles of the laity.

The superintendent of the Navy Nurse Corps, after reading the book, reported that it gave the student nurse a fundamental knowledge of all the important points of the subject, and that this knowledge should serve as a guide throughout the nurse's life.

One of the impressive features of the book is the portrait facing the title-page. This is called "Unique American" and is by Reni-Mel, president of the Center of Arts, Paris. The original is hanging in the headquarters of the Henry Street Visiting Nurse Service, New York. Reni-Mel called it the Unique American because he thought the nurse typified the most American thing in America.

CROSS SECTION OF RURAL HEALTH PROGRESS; REPORT OF THE COMMONWEALTH FUND CHILD HEALTH DEMONSTRATION IN RUTHERFORD COUNTY, TENN., 1924-1928, by *Harry S. Mustard, M. D., Director, Rutherford County Demonstration*. The Commonwealth Fund, Division of Publications, New York, 1930.

The Commonwealth Fund Child Health Demonstration in Rutherford County, Tenn., covered the period from January, 1924, through December, 1928. This was one of four such demonstrations. The first, in Fargo, N. Dak., 1923-1927, is reported in *Five Years in Fargo* (New York: The Commonwealth Fund Division of Publications). The demonstration in Clarke County, Ga., covering the same period as that in Rutherford County, is reported in *A Chapter of Child Health*, published under the same imprint. The last of the four, in Marion County, Oreg., ended on December 31, 1929, and will be separately reported. The record of this 5-year undertaking, its successes and its failures, should throw light on the results of applying generally accepted public health practice to a fairly typical southern rural community. A group of competent workers

undertook a specific piece of work, operating in certain instances along lines more or less standard and in other instances along lines somewhat experimental from an administrative standpoint. An objective attitude was maintained, so far as possible, in studying organization accomplishment and community reaction.

Both in the field work and in the wording of his report the author has turned out a job that stands out like a perfectly cut gem. One can see all through it his inspiration and his relentless striving for scientific precision and thoroughness coupled with a wholesome share of practical public-health knowledge and good common sense.

E. L. Bishop, commissioner of public health, State of Tennessee, has contributed a brilliant foreword. To quote Doctor Bishop:

That success has, in large measure, been attained by the demonstration is proved by its influence on the public-health program of the State as a whole, by its stimulus to similar methods of approach in the fields of both technical and administrative methods, and by the fact that it has been continued as the county health department of the local community with adequate financing, the last being an evidence of successful achievement as measured by that most sensitive index—the public pocketbook. . . . With some of these opinions I frankly disagree, but this disagreement is in itself evidence of the intrinsic value of the report. Complete agreement would indicate that all problems had been settled, all points of difference reconciled, and a report so written would be destructive rather than constructive, since, obviously, public-health administration has not yet shed its swaddling clothes.

The printing and binding show an excellence of taste in keeping with the other high merits of the report.

PERSONAL AND COMMUNITY HEALTH, by *Clair Elsmere Turner, M. A., Dr. P. H., Professor of Biology and Public Health in the Massachusetts Institute of Technology; Formerly Associate Professor of Hygiene in the Tufts College Medical and Dental Schools; Major, Sanitary Corps, U. S. A., (Reserve)*, Third Edition. C. V. Mosby Co., St. Louis, 1930.

A rather elementary text designed for students, and in a form that makes it valuable as a treatise for general reading. Of particular value is a section of 60 pages which contains the 1925 revised report of the Committee for the Control of Communicable Diseases, adopted by the American Public Health Association in 1926. This report covers in summary the accepted methods of control in 42 communicable diseases.

The book has reached its third edition since 1925.

REFRACTION OF THE HUMAN EYE AND METHODS OF ESTIMATING THE REFRACTION, by *James Thorington, A. M., M. D.; Sometime Professor of Diseases of the Eye in the Philadelphia Polyclinic and College for Graduates in Medicine, etc.* Second Edition. P. Blakiston's Son & Co., Philadelphia, 1930.

The first edition of this book is so well known to medical officers specializing in eye work that no comment is necessary beyond the mention of the appearance of this new (second) edition.

This edition, of course, includes the latest methods of procedure. Deletions have been made of methods now discarded which appeared in the previous edition.

The book's distinct popularity is well merited and is very probably due to the fact that it is the most handy and practical work on the subject in English.

CHRONIC NASAL SINUSITIS AND ITS RELATION TO GENERAL MEDICINE, by *Patrick Watson-Williams, Honorable Consulting Surgeon in Diseases of the Ear, Nose, and Throat, Bristol Royal Infirmary, etc.* William Wood & Co., New York, 1930. Price \$5.

An interesting and handsomely illustrated 200-page monograph based on the author's Semon lecture, University of London, "The Toll of Nasal Focal Sepsis on Body and Mind."

Some of the therapeutic measures described are, unfortunately, those that have been generally discarded by the American profession.

ANATOMY, by *George W. Corner, M. D., Professor of Anatomy in the University of Rochester.* Paul B. Hoeber, New York, 1930. Price \$1.50.

This is a small pocket volume on the history of anatomy and forming one of a series on the history of medicine. It is a brief sketch with a number of illustrations reproduced from the classics of anatomy. The great part in the development of the science taken by Vesalius, Leonardo da Vinci and by the successor of Vesalius at the University of Padua, Fallopius, as well as by Coiter and Fabricus, respectively, the pioneers in comparative anatomy and embryology is well given.

Of interest also is the author's final chapter on current trends in anatomy. As he points out, the knowledge of gross anatomy, histology, and embryology has been well established by the great draughtsman anatomists of the past, and that in the future anatomy will have to concern itself more with the relation of structure to function. To those who fear that the anatomist will in consequence become a physiologist, the author answers that anatomists have always been physiologists and that the questions "How is it constructed?" and "How does it work?" are inseparable.

STALKERS OF PESTILENCE, THE STORY OF MAN'S IDEA'S OF INFECTION, by *Wade W. Oliver, M. D., Professor of Bacteriology, Long Island College Hospital; Visiting Professor, University of the Philippines (Auspices of the Rockefeller Foundation).*—Paul B. Hoeber, New York, 1930. Price, \$3.

A beautiful little volume of 226 pages which briefly traces the historical development of man's ideas of the nature of infectious diseases. Theobald Smith writes an interesting foreword. There are several pages of references and 23 illustrations.

The busy practitioner will find instructive entertainment in an evening's perusal of the epochal facts and theories of medicine as here unfolded in the lives of the great originators.

THE CANDIRÚ, THE ONLY VERTEBRATE PARASITE OF MAN, by *Eugene Willis Gudger, Ph. D., Bibliographer and Associate in Ichthyology, American Museum of Natural History, New York City.*—Paul B. Hoeber, New York, 1930. Price, \$1.50.

It is a great temptation to the reviewer to be facetious in regard to this book and dismiss it as a big fish story about a little fish. The Candirú is a fish of the Amazon Valley that is said to have the habit of penetrating the urethra of men and women bathers, particularly if they should pass urine while in the water.

Certain small Amazon fishes are parasitic and penetrate the gills of other fish. By means of erectile recurved spines they maintain themselves in the host. The author, however, does not make a very convincing case of the belief that these fishes are urinophilous and penetrate the genito-urinary tract of man. He shows that they have been found in the vagina and that the natives of the Amazon Valley are in the habit of wearing protective covering to the genitalia when bathing, but apparently this is as much a precaution against mutilation by fish of the barracuda type as against the invasion of the Candirú.

While an excellent theme for a scientific paper and not without interest as possibly the only vertebrate endoparasite of man, the subject is rather a slight one out of which to make a book.

THE PATHOLOGY OF DIABETES MELLITUS, by *Shields Warren, M. D., Pathologist to the New England Deaconess Hospital, the New England Baptist Hospital, and the Huntington Memorial Hospital, Boston, etc.* Lea & Febiger, Philadelphia, 1930. Price, \$3.75.

Although insulin is a Canadian product, a large share, perhaps the largest share, of contributions to our understanding of diabetes comes from the New England Deaconess Hospital. Much of the reason for this lies in the influence, or better the inspiration brought to his associates by Dr. Elliott Joslin, who, by the way, has written the foreword for this book.

There are 200 pages, with 83 engravings and 2 colored plates.

The author has had the cooperation of numerous individuals and institutions in the compilation of the text.

A list of some of the chapter titles will indicate the scope of the book:

The Acino-insular Hypothesis; Histology of the Normal Pancreas; Qualitative and Quantitative variations in the Island of Langerhans in diabetes; Pathological Evidence of Abnormal Carbohydrate Metabolism and of Abnormal Fat Metabolism; the Pathology

of Acidosis and Coma; Arteriosclerosis and Gangrene; Pathology of the Nervous System, Pathology of Insulin-Resistant Cases; Theories as to the Etiology of Diabetes.

A TEXTBOOK OF PATHOLOGY, edited by *E. T. Bell, M. D., Professor of Pathology in the University of Minnesota, Minneapolis, Minn.* Lea & Febiger, Philadelphia, 1930. Price, \$8.

This is written by five pathologists—E. T. Bell, B. J. Clanson, H. Downey, J. S. McCartney, J. C. McKinley, and C. J. Watson—at the University of Minnesota, and is edited by E. T. Bell.

It represents an attempt to present the essential facts of pathology to medical students. The illustrations are abundant in number and are all of high quality.

A TEXTBOOK OF PHYSIOLOGY, by *William H. Howell, Ph. D., M. D., Sc. D., LL. D., Professor of Physiology in the School of Hygiene and Public Health, Johns Hopkins University, Baltimore.* Eleventh Edition. W. B. Saunders Co., Philadelphia, 1930.

Howell's Physiology has been a standard text in America for so many years that it needs no comment beyond the announcement of the appearance of a new (eleventh) edition.

Much of the descriptive character of earlier physiologies is replaced or supplemented here by expositions of fundamental principles.

ANATOMY OF THE HUMAN BODY, by *Henry Gray, F. R. S., Fellow of the Royal College of Surgeons; Lecturer on Anatomy at St. George's Hospital Medical School, London.* Twenty-second Edition, thoroughly revised and reedited by *Warren H. Lewis, B. S., M. D., Professor of Physiological Anatomy, Johns Hopkins University, Baltimore, Md.; Research Associate, Carnegie Institution of Washington.* Lea & Febiger, Philadelphia, 1930. Price, \$10.

A splendid addition which appears in the 1930 (twenty-second) edition of this standard work is the frontispiece portrait of Henry Gray, together with a page devoted to an account of his career, taken from the St. George's Hospital Gazette, 1908.

Gray's book was first published in 1858, then containing 750 pages and 363 figures. Gray then had the help of his friend, Dr. H. Vandyrke Carter, a skilled draughtsman and anatomist, who made the drawings from which the engravings were executed.

The changes made through the many subsequent editions have been largely due to the advance in our knowledge of microscopic anatomy and anatomy of the embryo. More recently, the principal change has been in the revision of the section on the central nervous system and on the physiological anatomy of the various organs.

HANDBOOK OF ANATOMY, by *James K. Young, M. D., F. A. C. S., Late Professor of Orthopaedics, Graduate School of Medicine, University of Pennsylvania, etc.* Revised by *George W. Miller, M. D., F. A. C. S., Associate in Anatomy, Jefferson Medical College; Surgeon to Montgomery Hospital, Norristown, Pa.* Seventh Edition. F. A. Davis Co., Philadelphia, 1930. Price, \$3.75.

An extremely handy and an attractive appearing little anatomy covering some 450 pages, designed "to lighten the labor of the student of medicine."

It could be used to advantage by those of the Hospital Corps who want to pursue the subject at greater length than would be possible with the Handbook of the Hospital Corps and yet would find forbidding the books that have reached the size of Gray or Cunningham. It should be of value to all those who desire a ready reference to anatomical subjects.

The latinized form of the Basle Nomenclature is used throughout.

PROSTHETIC DENTISTRY, by *Ira Goodsell Nichols, D. D. S., Lieutenant Commander, DC-V (S), U. S. N. R.*, with the collaboration of 45 authorities. C. V. Mosby, St. Louis, 1930. Price, \$12.50.

The author has endeavored in this work to cover in one volume the entire subject of prosthetic dentistry. Forty-five outstanding authorities have assisted him in this endeavor. The names of his collaborators assure the advanced and competent handling of the various phases of the subject. The author, a dental officer of the Naval Reserve and a civilian prosthodontist of high standing, pays tribute in his preface to the valued assistance rendered him in this work by certain officers of the Dental Corps of the Navy in conjunction with civilian specialists. The varying phases of the subject are covered in some instances in detailed and, in others, in condensed form. Each chapter is worthy of special notice. A striking chapter is that on "Prosthetic Restorations of Deformities of Face and Jaw." The book is profusely illustrated, represents a vast amount of intelligent effort, and is a noteworthy addition to dental literature.

A TEXTBOOK OF OPERATIVE DENTISTRY, by *William Harper Owen McGehee, D. D. S., M. D., Head of the Department of Operative Dentistry; Professor of Operative Technology and Secretary of the New York University College of Dentistry.* With 1,040 illustrations. P. Blakiston's Son & Co., Inc., Philadelphia, 1930.

In accordance with his views as to the proper make-up of a modern textbook on operative dentistry, the author of this work has limited his endeavor to a comprehensive and able discussion of the diagnosis, prevention and treatment of affections of the oral cavity resulting from dental caries, erosion or abrasion, from exposure or infection of the dental pulp and its sequelae, and of manifestations of patho-

logical disturbances of the peridental membrane resulting from diseases of the dental pulp.

The work has been planned primarily for the use of dental instructors and students. The arrangements of chapters and subjects are in accordance with the object sought and are presented in logical sequence. Sections on diagnosis, oral hygiene and preventive dentistry, and a description of certain modifications of former methods of cavity preparation, recommended by the author, are noteworthy, as is his close adaptation throughout the work to accepted dental nomenclature.

The book is well published, clearly and amply illustrated, and should prove a valuable addition to dental literature.

LABORATORY MEDICINE, A GUIDE FOR STUDENTS AND PRACTITIONERS, by *Daniel Nicholson, M. D., Member of the Royal College of Physicians, London; Assistant Professor of Pathology, University of Manitoba.* Lea & Febiger, Philadelphia, 1930. Price, \$6.

A handy reference of medium size which should serve well as a manual for laboratory workers and students. There are many useful tables of normal standards.

All branches of laboratory work are covered in nice detail and are treated throughout from the practical rather than academic standpoint.

While most of the matter is devoted to technique, sufficient consideration is also given in each chapter to indications and interpretations.

DISEASES OF THE SKIN, A TEXTBOOK FOR PRACTITIONERS AND STUDENTS, by *George Clinton Andrews, A. B., M. D., Associate Professor of Dermatology, College of Physicians and Surgeons, Columbia University; Consulting Dermatologist and Syphilologist to Tarrytown Hospital, etc.* W. B. Saunders Co., Philadelphia, 1930.

Another formidable volume on dermatology. The author has followed the traditional pattern of the several American dermatologists who write 1,000-page books on the subject. There are 988 well-chosen illustrations.

The author has endeavored to gather and to present in a lucid and intelligible manner, the tried and conservative principles of dermatology with the most recent developments, to evaluate them and to correlate them into one satisfying, orderly whole.

The photographs of syphilitic lesions are taken from the remarkable collection of Dr. M. B. Parounogian who has been collecting these in his service at the Bellevue Hospital during the past 25 years.

PHYSIOLOGICAL CHEMISTRY, by *Albert P. Mathews, Ph. D., Carnegie Professor of Biochemistry, University of Cincinnati.* Fifth Edition. William Wood & Co., New York, 1930. Price, \$7.

A very thorough and valuable treatise, built on the usual pattern, and covering some 1,200 pages. This book answers many fundamental questions in the enormous science of biochemistry. The chapters on the physical chemistry of the cell and on the chemistry of proteins, fats, and carbohydrates are longer than in most texts.

That the book has gained wide recognition is shown by the facts that it has reached its fifth edition and has been published in Spanish and Italian.

HANDBOOK OF THERAPEUTICS, by *David Campbell, M. C., M. A., B. Sc., M. D., "Pollok" Lecturer in Materia Medica and Pharmacology in the University of Glasgow; Assistant Physician to the Western Infirmary of Glasgow; etc.* William Wood & Co., New York, 1930. Price, \$4.50.

A very handy little book, almost pocket size, containing some useful tables as well as the usual text. The therapeutic measures described are limited rather strictly to those that the author has found useful in his long experience. His views on pellagra are those that were commonly held some 15 years ago.

DIETETICS AND NUTRITION, by *Maude A. Perry, B. S., Formerly Director of Dietetics at Michael Reese Hospital, Chicago, Ill., and at Montreal General Hospital, Montreal, Canada.* C. V. Mosby Co., St. Louis, 1930. Price, \$2.50.

The author presents material in the fields of dietetics and nutrition in plain language that will meet the needs of student and graduate nurses, physicians, teachers, and others who are interested in this phase of personal and public health.

The section on diets for food deficiency diseases is admirable, taking full account of our latest knowledge in this chapter of medicine.

While the material has been derived from many sources, much of it comes from the ripe experience of the author, covering a long period of years in writing, lecturing, in hospital and university work, and in feeding both sick and well people.

A TEXTBOOK OF MESSAGES FOR NURSES AND BEGINNERS, by *Maude Rawlins, Instructor of Massage to Nurses at St. Johns Hospital, Brooklyn, and Long Island College Hospital, Brooklyn, etc.* The C. V. Mosby Co., St. Louis, 1930. Price, \$2.

Thirty years of work in this field of therapy and in teaching the methods to nurses well enables and entitles the author to put together this very useful little book, dealing with a very useful branch of therapy. There are 140 pages and 18 illustrations.

Twenty-four chapters cover very nicely the different sections of the subject.

A PRACTICAL MEDICAL DICTIONARY, by *Thomas Lathrop Stedman, A. M., M. D., Editor of the "Twentieth Century practice of Medicine" and of the "Reference Handbook of the Medical Sciences."* Eleventh Edition. William Wood & Co., New York, 1930. Price, \$7.50.

This dictionary enjoys the advantage of being, at this writing, the latest one off the press, a consideration of much importance in medical dictionaries. This makes it better—fortunately it is no bigger—than the previous edition. This edition includes the names of new preparations in the tenth decennial revision of the United States Pharmacopœia and of the fifth edition of the National Formulary.

It is a matter of great satisfaction to the compilers to be able to say that one of the primary objects of this work, namely, the purification of medical orthography has, after two decades of patient effort, been nearly attained.

This is the eleventh edition that has appeared since 1908.

THE DIVISION OF PREVENTIVE MEDICINE

Capt. W. H. BELL, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

AN EPIDEMIC OF BACILLARY DYSENTERY IN THE UNITED STATES FLEET

By W. H. BELL, Captain, Medical Corps, United States Navy

During March and April, 1930, an epidemic of bacillary dysentery and other intestinal infections occurred among the personnel of various ships then operating in the Guantanamo area.

Reports covering the epidemiological and other pertinent data have been received from the ships concerned and these reports now seem sufficiently complete to warrant a study of the data with the hope of arriving at some useful conclusions.

Some of the reports received are presented here in their original forms; from others certain facts have been extracted which appear to be of value in the determination of the causative factors and in the formulation of effective methods of prevention.

REPORT FROM U. S. S. "CALIFORNIA"

An outbreak of 238 cases of bacillary dysentery and acute diarrhea occurred on the U. S. S. *California*, April 2 to April 28, 1930. As is usual in epidemics, many mild cases did not report for treatment, and therefore were not admitted to the sick list, and can not be included in the tabulations of cases. The following is a study of the epidemiological features of the outbreak:

Etiology.—The feces of a typical case, transferred to the U. S. S. *Relief* near the end of the outbreak, was found to be positive for the Flexner type of dysentery bacillus. The diagnosis and causative agent was indicated early in the epidemic by the almost immediate beneficial results obtained from the use of polyvalent antidyenteric serum.

Spread.—The following factors may have influenced the spread of the disease: (a) Cases were discharged to duty when physically well, it being impracticable to culture their feces to determine absence of the infective microorganism before discharge. (b) No disinfecting solutions were placed in crew's heads, and all men visiting heads

were not required, under sentry supervision, to disinfect their hands thoroughly before leaving head. (c) Due to influx of cases, surgical operations, employment of the ship, and other conditions, it was not possible to employ complete typhoid precautions of disinfection in all cases.

The following procedures may have retarded the spread of the epidemic: (a) All mess cooks and food handlers were frequently inspected, and those with a history of intestinal disorder were relieved from duty as food handlers, and kept under observation. (b) All mess cooks and food handlers were required to come immediately to the sick bay after visiting the head, and to thoroughly disinfect their hands in a solution of bichlorid of mercury. (c) Sale of ice cream restricted to one serving per man, after meal hours only. (d) Temperature of water in crew's scuttle butts was raised from 45° to 60° F.

Relationship of incubation period to outbreak.—The normal incubation period of bacillary dysentery is recognized to be two to seven days. The itinerary of the *California* for three weeks prior to its outbreak, beginning on April 2, was: March 10, left Cristobal, Canal Zone; March 10–15, at sea, United States Fleet Problem X; March 16–23, at anchor, Guantanamo Bay, Cuba; March 24–28, at sea, United States Fleet tactical exercises; March 29–30, at anchor, Guantanamo Bay, Cuba; March 31–April 2, at sea, force battle practice. Therefore, the source of infection ordinarily would seem to have been some factor in the Guantanamo Bay area.

Chronological history of outbreak until California epidemic occurred.—The following chronological history of the outbreak of bacillary dysentery and acute diarrheal conditions, prior to the epidemic on the *California*, is of interest:

1. It was reported that bacillary dysentery was prevalent in the Canal Zone and that the Army forces there were just recovering from an outbreak of the disease when the Battle Fleet was in the Canal Zone, February 28 to March 10, 1930.

2. The *Camden* sailed from Cristobal March 4 and arrived in Guantanamo Bay March 7. On March 24 it was reported to the commander in chief, Battle Fleet, that there were 16 cases of bacillary dysentery on board the *Camden* at the time, and that a total of 45 cases had occurred since leaving Panama.

3. An outbreak began on the *Mississippi* about March 20, while at anchor in Guantanamo Bay.

4. An outbreak of acute enterocolitis began on the *Relief* March 25, 14 cases occurring between that date and April 3.

5. Outbreak of bacillary dysentery and acute diarrhea on the *California* began April 2.

No cases occurred in the concentrated United States Fleet prior to leaving Cristobal, March 4 to 9, for the concentration at Guantanamo. The *California* was berthed alongside dock in both Balboa and Cristobal; there were a few visitors on board at both places, but no relationship can be seen between an outbreak of dysentery and the berthing and visitors. Large liberty parties went ashore in each place; only officers and chief petty officers were permitted ashore after 6 p. m.

While in Guantanamo no liberty to enlisted men was granted, except for recreation parties to the naval station. During the period April 19 to 29 a few men were permitted to visit Guantanamo City, Cuba, but the epidemic on this ship and in the concentrated fleet had practically ended by that time.

Origin.—Nineteen early cases were diagnosed as gastroenteritis, and it was thought at the time that they were caused by the ingestion of large quantities of ice cream and ice water, particularly by members of the engineer force. But upon checking rates of men attacked it was found that only nine were members of the engineer force, while seven belonged to the deck force, and three to other divisions. It is, however, possible that the ingestion of large quantities of ice cream and very cold water may have lowered the resistance of the gastrointestinal tract to invasion by bacteria, thus increasing susceptibility to infection. The patients were questioned individually regarding the following particulars:

1. Liberty and dietary habits in Panama and Colon.
2. Liberty and dietary habits in Guantanamo Bay.
3. Dietary habits on board, including mess and division, and ingestion of cold water, ice cream, and fresh fruits.
4. Swimming over side, or at other locations in Guantanamo Bay.

Water.—All water used for drinking and cooking purposes passed through the ship's distillation plant. A specimen of water from the ship's tanks sent to the U. S. S. *Relief* for bacteriological examination was found to be negative for gas formers and typhoid-enteriditis-dysentery group of bacilli.

Swimming over side and at other locations in Guantanamo Bay was permitted during periods March 16 to 23 and March 29 to 30. As noted before, a study of the swimming factor showed that only half of those attacked had been in swimming. Water from the bay was used for washing down decks, scrubbing mess tables and benches, and, in a comparatively few instances, for washing clothes.

Guantanamo Bay was most likely heavily polluted with fecal wastes from the ships anchored there. The question, consequently, arises at once, whether or not the origin of the cases of dysentery and other acute diarrheal conditions did not result from infection by such water. Swimming was indulged in by all men of the an-

chored ships, and bay water was used for scrubbing decks and washing mess tables and clothing. The chronological history of the epidemic, prior to the beginning of the *California* outbreak on April 2, has been given above. The *California* outbreak began while at force battle practice, after having been at anchor in Guantanamo Bay with all water factors present from March 16 to 23 and March 29 to 30. There was, therefore, possible contamination of Guantanamo Bay water with dysenteric or acute diarrheal fecal wastes between the dates March 7 to 30.

No cases of bacillary dysentery had occurred in the Scouting Fleet or at the naval station, Guantanamo, prior to the arrival of the *Camden* and the Battle Fleet; and none occurred subsequently except a few sporadic cases on ships of the Scouting Fleet. It would seem that, up to this point, the cause of the outbreak could be regarded pretty definitely as the polluted water of Guantanamo Bay, yet when the situation is further examined it is not seen how the polluted water can be incriminated.

The *Camden* and the *Relief* were anchored remote from the battleships of the Battle Fleet, to which ships the subsequent development of the outbreak was almost entirely confined. All battleships of the Battle Fleet were anchored in the same vicinity, and the battleships of the Scouting Fleet were anchored in adjacent areas. The water factors—possible pollution, swimming, deck, mess tables, and clothes washing—were common to all ships, yet the *California* and the *Mississippi* were the only ships affected at the time. The *Texas*, anchored immediately ahead of the *California*, had no cases, while the *West Virginia*, anchored immediately astern of the *California*, did not have any cases until about two weeks later. It should be borne in mind that the recognized incubation period of bacillary dysentery is 2 to 7 days. The *Tennessee* did not have any cases for more than a month after the beginning of the *California* outbreak, yet that ship was under identically the same conditions as to polluted water as the *California* and other battleships. Only about 50 per cent of the *California*'s cases had been swimming in Guantanamo Bay.

To summarize: As to the possibility of the polluted water of Guantanamo Bay being the source of the outbreak on the *California* and other battleships of the Battle Fleet, it can reasonably be said that a large source of infection presented simultaneously to a large group of personnel would produce an explosive, mass outbreak. Yet the opposite of this condition occurred in the present instance, and bearing in mind the incubation period of bacillary dysentery, a study of the incidence chart of the outbreak on board the *California* would suggest that the cases occurring after April 7 resulted from contact

with infected wastes or materials of the initial group of 28 cases occurring between April 2 and April 7, rather than from water from the bay.

Milk.—No fresh milk was served to the crew during the period under consideration.

Mess Gear.—All crew's mess gear was regularly sterilized in the ship's scullery. After the outbreak began this was supervised by a Hospital Corps man to insure that adequate sterilizing temperatures were maintained in the sterilizing tanks.

Uncooked vegetables and fruits.—No uncooked vegetables were served to the crew. One serving of grapefruit occurred on March 21. The fruit was purchased at Caimanera. It is possible that some of the fruit may have been infected on the outside with dysentery bacilli and introduced into the bodies of the men from handling the contaminated rinds while eating them. This theory of origin would seem to be ruled out because no recognized cases developed until after an intervening period of at least 10 days. A careful interrogation of infected men as to the ingestion of fruits in Guantanamo failed to reveal any relation to the outbreak. Further, fruits from the same sources had been served to personnel of the Scouting Fleet since early in January without the development of bacillary dysentery or other acute diarrheal conditions.

Ice cream.—Ice cream is prepared on board and sold to the men through the ship's service store. All ingredients, such as powdered milk, sugar, water, and flavorings were from stocks on board. Nothing entering into the manufacture of ice cream was obtained from shore. A specimen of the ice cream was found to be negative for typhoid-enteriditis-dysentery group.

Flies.—There was no great number of flies about the ship at any time during the outbreak.

Carriers.—The possibility of men becoming carriers through contact with infective microorganisms in the Canal Zone, Panama area, and remaining latent carriers until shortly prior to the outbreaks would seem likely if the intervening period were not so long. Liberty for the crew began at Balboa-Panama City February 28 and ended at Cristobal-Colon March 8. The last possible opportunity for contact with the population ashore in the Canal Zone, Panama area, therefore, was March 8, and then only for relatively a few men. Yet it was 12 days before a case occurred on the *Mississippi* and 22 days before a case occurred on the *California*.

Liberty was general from all of the ships, and the liberty parties at Balboa and Panama City were, as might be expected, very large. Both places are quite small considering the large number of men ashore each day, and practically all men ashore were subjected to the

same conditions and visited the same areas. Thus, exposure to shore conditions in the Canal Zone, Panama area, was quite uniform for all enlisted personnel of the Battle Fleet.

The *Idaho* gave liberty from February 28 to March 3, inclusive, at Balboa-Panama City, then went to navy yard, Puget Sound, Wash. No cases of dysentery or acute diarrhea occurred then or later.

The *Colorado* en route to join the fleet gave two sections liberty on April 18 in Balboa-Panama City. The ship joined the fleet in Guantanamo Bay April 21 and remained there until April 30, when she sailed with the fleet for New York. All swimming in the bay had been discontinued at that time, as well as the use of bay water for washing mess tables. Bay water, however, was used to wash decks, and the deck force at least were thus exposed to infection by such water, yet no cases of dysentery or acute diarrhea developed on the *Colorado*.

No men were received by transfer from the *Camden*.

If exposed to bacillary dysentery and infected, even in very mild form, it is reasonable to assume that there would have been cases occurring within the maximum incubation period of seven days. No mild cases of diarrhea were noted prior to the beginning of the outbreaks, suggesting an epidemic building up in virulence from a series of very mild cases.

Intense heat and humidity as a predisposing factor.—It is always hot below decks on capital ships while in the Tropics, but when such ships are operating in the Tropics under battle conditions, with all boilers lit off for reserve speed and everything closed to darken ship at night, the heat and humidity become almost insufferable.

These latter conditions obtained on the *California* and other battleships of the Battle Fleet present at fleet concentration between March 10 to 15 and March 24 to 28.

The personnel of battleships of the Scouting Fleet had been under conditions of tropical heat since early in January. After the arrival of the Battle Fleet they operated as a part of the United States Fleet in battle problems and tactical exercises and were under the same conditions of intense heat and humidity, yet they suffered from neither bacillary dysentery nor acute diarrhea.

Conclusions.—After consideration of the data presented above, it would seem that the outbreak of bacillary dysentery and acute diarrhea on the *California* and other ships during fleet concentration, originated in the Canal Zone, Panama area. But the means by which the transmission of the infective microorganisms to the personnel at the beginning of the outbreak on board each ship was effected remains undetermined at the present writing (May 29, 1930).

Preventive measures suggested by "California" epidemic.—From a study of the outbreak on the *California*, the following preventive measures appear to be of paramount value when cases of bacillary dysentery or acute diarrhea occur in the Tropics:

1. Regard every case of what appears to be acute gastroenteritis, acute enterocolitis, and acute enteritis when in tropical waters as bacillary dysentery. Immediately isolate such cases and carry out complete disinfection, as for typhoid, during the course of the disease and for one week after clinical symptoms have disappeared.

2. If enough cases occur to suggest a possible outbreak, place buckets of disinfecting solution in the crew's heads and require every man visiting heads to disinfect his hands before leaving. Have a sentry on duty at all hours to see that this requirement is carried out. Place similar buckets of disinfecting solution in officers' heads and instruct officers relative to their use.

3. Inform the crew as to the necessity of reporting at the sick bay immediately upon the appearance of symptoms. This can be emphasized through the ship's morning orders and, personally, by medical officers, division officers, or division petty officers. The latter are particularly effective in detecting mild cases.

4. Exercise close supervision of mess cooks and food handlers at all times for the early detection of those suffering with diarrhea in any form.

5. Sterilize all mess gear after each meal, under the supervision of members of the Medical Department to insure that adequate temperatures are maintained.

U. S. S. "MISSISSIPPI" REPORT

The U. S. S. *Mississippi* left the Panama Canal zone March 10, 1930, and anchored in Guantanamo Bay, Cuba, from March 15 to March 24, 1930, and operated in this area until April 2, 1930.

From March 19 to May 1 there appeared 83 cases of diarrheal disease on board this vessel; of these, 34 were carried under a diagnosis of enteritis or gastroenteritis, and 49 under a diagnosis of bacillary dysentery. Nine of these cases were diagnosed as dysentery aboard the U. S. S. *Relief*, as positive cultures were demonstrated in a certain proportion of the severe cases.

The first case developed in the crew on March 19, and from March 21 to 25 a number of cases developed in the junior officers' mess, including two Filipino mess attendants, all apparently traceable to the eating of a raw vegetable salad, vegetables for which were purchased at Caimanera, Cuba. About the same time sporadic cases began to appear among the crew and were not confined to any one division.

From March 19 to April 5, while in the Guantanamo area and en route to Bridgetown, Barbados, 28 cases occurred, the majority of which gave a history of being ashore on recreation parties and swimming in Guantanamo Bay. There were 12 swimmers and 8 nonswimmers recorded at this time. From April 8 to 18, while in Bridgetown, Barbados, and en route to Guantanamo Bay, 35 cases occurred. From April 18 to 21, while at Guantanamo Bay, 16 cases occurred, and from the 21st to the 26th, en route to Hampton Roads, Va., only 4 new cases developed. These were milder cases, and by the 3d of May all patients were well and had returned to duty.

While this vessel was in transit through the Panama Canal on March 6, 1930, from Balboa to Colon, Panama, 6,825 gallons of water were passed through the evaporators and stored in the double bottoms for boiler feed. None of this water was used for drinking purposes. During the transit of the canal the exposed decks and paintwork were scrubbed and washed down with water from Gatun Lake, pumped through the fire hose, with salt-water pumps. During the period of this outbreak no water was consumed aboard, except water passed through the evaporators.

From March 15 to 24, while at anchor in Guantanamo Bay, the data for the first effect evaporator was as follows:

Temperature	Vacuum	Maximum pressure (absolute)
	<i>Inches</i>	<i>Pounds</i>
244° F.....	4½	12
190° F.....	11	9.7

The fresh-water situation, however, was acute during this period, due to excessive expenditure which taxed the capacity of the evaporator plant to the limit. Precautions were taken to prevent the evaporators being forced. As soon as opportunity offered, samples of water from the ship's tanks and the evaporators were sent to the United States Naval Dispensary at Guantanamo, Cuba, and these samples were reported negative for colon bacilli.

All food was carefully inspected, and during this period about 1,000 pounds of canned beets were surveyed, as these were packed in 1927 and the tins were rusty, leaked, and some bulged. After the onset of the outbreak no raw vegetables were allowed any of the messes, and swimming was not permitted from the ship, but allowed from the beach.

The officers and men were subjected to all the factors predisposing to intestinal diseases: Sudden climatic change from Bremerton, Wash., to the enervating heat of the Tropics, with resulting lowered

resistance; subjected to heat while below, with consequent chilling of the body above decks, particularly at night; eating of tropical fruits and possibly contaminated vegetables; swimming in sewage-polluted water at Guantanamo Bay, Cuba; eating indigestible food and unripe fruit while on liberty at Bridgetown, Barbados.

The infective nature of this outbreak was recognized early, and preventive measures were put in effect and maintained. Briefly, they were as follows:

1. The crew was informed of the personal sanitary precautions to be taken to avoid infection on board and ashore, and advised to report promptly to the sick bay upon the first symptoms of intestinal disorder.

2. Special attention to sterilization of mess gear, the handling of foodstuffs, and general sanitation of the ship.

3. The examination of mess attendants, cooks, butchers, bakers, mess cooks, food handlers, etc.

4. The disinfection of the toilet seats of all heads and the valve handles of scuttle butts handled constantly by the crew.

5. Cases discharged from the sick list were not allowed to be detailed as food handlers or mess cooks.

6. Concomitant disinfection was used in the handling of all cases admitted to the sick list.

7. Patients were kept on the sick list under concurrent disinfection for some time after convalescence was established.

Summary.—During the outbreak 83 cases were admitted to the sick list, making the attack rate 6.5 per cent. The onset began shortly after anchoring in Guantanamo Bay, Cuba. Investigation did not determine the source of the outbreak, although contaminated vegetables or fruits, contamination of the ship's water supply, and swimming in sewage polluted water were all considered.

Conclusions.—

1. It is believed the water of Guantanamo Bay, Cuba, is dangerously contaminated with pathogenic intestinal bacteria during the concentration of the combined fleet.

2. That this contamination is necessarily near the individual ship.

3. That swimming off the ship might have been the original source of the infection.

4. The possibility of pathogenic bacteria passing through the evaporators is still undetermined and bacteriological studies should be made to determine this question.

5. That the eating of uncooked contaminated vegetables or fruits might be a source of infection in officers' messes.

6. Considering the infectious nature of this disease, the attack rate was considered to be well controlled.

U. S. S. "WEST VIRGINIA" REPORT

On April 12, 1930, while the ship was lying off the Port of Spain, Trinidad, a case of bacillary dysentery appeared on board. The clinical symptoms were characteristic and typical—onset with general malaise, headache, pains in the back and limbs, a moderate elevation of temperature, furred tongue, generalized cramplike pains in the abdomen, and frequent watery stools which contained mucus and some blood.

Examination of the stools showed many gram-negative bacilli but no amebae. Knowing that bacillary dysentery is endemic in the Port of Spain it was of course natural to inquire into a possible origin of this case from water drank while ashore. In this instance it seemed likely that there was a direct connection between the water consumed on shore and the onset of the attack of dysentery. This was the case of an officer who went ashore with a baseball party, and while there drank a large quantity of water from a bucket brought to the ball ground by one of the natives. About 48 hours later he developed a severe attack of bacillary dysentery, with symptoms as above enumerated.

Nine cases of bacillary dysentery occurred while the ship was at Port of Spain. Most of them were mild in character, lasting from four to six days before complete recovery. In each case, except the one above cited, a careful inquiry failed to reveal any definite connection between the onset of the disease and any food or water ingested while ashore.

En route to Guantanamo Bay, Cuba, from Port of Spain, Trinidad, 17 cases of bacillary dysentery occurred. A few were severe but the majority mild, only the severe ones showing blood and mucus in the stools.

Upon arrival in Guantanamo Bay, Cuba, April 21, 1930, there were 16 cases of bacillary dysentery on the sick list. Several days later it was learned that the Scouting Fleet ships had brought bacillary dysentery to the harbor from the Canal Zone some time in January, and that several of these ships, notably the U. S. S. *Camden* and the U. S. S. *Oglala*, had developed a large number of cases on board. The fact that these ships had been in Guantanamo Bay for some time made harbor pollution with bacillary dysentery organisms seem a certainty.

The number of cases of bacillary dysentery were increasing on board the U. S. S. *West Virginia*. Interdiction of the use of harbor water in scrubbing down mess tables had no influence in checking the number of cases. On April 19, 1930, all swimming in the harbor was discontinued by personnel of the ship. On April 28, nine days later, in view of the fact that cases of dysentery were develop-

ing in increasing numbers, the use of harbor water on board was prohibited for all purposes except for the flushing system. That meant no washing down decks with salt water; no scrubbing of crew's clothing or bags and hammocks with salt water; no use of salt-water showers; no use of salt water for any purpose which would involve contact with it by the crew.

This interdiction of use of harbor water prevented any more contacts en masse by the crew with polluted harbor water. The epidemic stopped five days later on May 3.

In all, 105 cases of bacillary dysentery developed on this ship. The cases did not appear in any one mess or in any one section of the ship; nor did they come down in large numbers as would have been the case had there been a question of pollution of the ship's drinking-water supply. The fact that the epidemic ceased within a time covering the incubation period of the disease from the date on which contact by the crew with the polluted harbor water was no longer possible makes quite logical the assumption that infection was propagated by salt water contaminated hands to food, and hence the irregular manner of the appearance of the cases in the various messes.

When the ship came through the Panama Canal from the west coast, no water from Gatun Lake was taken in the ship's tanks. Inasmuch as the incubation period of bacillary dysentery is from two to seven days and our first case did not appear until 33 days after leaving the Canal Zone, infection from this source can be ruled out. Accordingly there remain only two possible sources of infection, viz, Port of Spain, Trinidad, and Guantanamo Bay, Cuba, but since the epidemic promptly stopped with the cessation of use of harbor water in Guantanamo Bay it appears certain that this was the main source of infection. Several cases of a severe nature could be attributed to swimming in the harbor and after washing clothes in harbor water, since the symptoms of disease began 48 hours later.

Upon arrival in Guantanamo Bay from Trinidad, several convalescent cases (treated) and one severe new case (not treated) were transferred to the U. S. S. *Relief* for treatment. Bacteriological examination of the treated cases on the U. S. S. *Relief* was negative; but in the untreated case a Flexner-Harris type of dysentery bacillus was isolated. Clinically all the cases were of the same type, symptoms varying only with the degree of severity exhibited. Inquiry as to the symptomatology of the cases of dysentery occurring on the U. S. S. *Mississippi* and U. S. S. *California*, brought information which indicated that all were of the same type; furthermore, as in the case of the U. S. S. *West Virginia*, a Flexner-Harris bacillus had been isolated from these cases by the hospital ship. Owing to the

lack of sufficiently extensive laboratory facilities no attempts were made on this ship to isolate the dysentery bacilli from the harbor water.

In order to aid in the control of the epidemic the following measures, in addition to isolation of cases and interdiction of the use of salt water, were instituted to prevent contact infections and diminish danger from possible carriers:

1. A separate mess of recovered dysentery cases was formed. All men joining this mess were to remain in it for 30 days. Mess gear from this mess was immersed in calcium chloride solution for 15 minutes, then cleansed in boiling water and live steam in the usual manner.

2. The decks of the living spaces were scrubbed with cresol solution twice a week; the deck in the sick-bay area thrice daily.

3. As soon as the ship cleared from Guantanamo Bay en route to New York all bags and hammocks were scrubbed with clean sea water, all decks thoroughly washed down, and all hammock nettings scrubbed with cresol solution.

4. All cots were scrubbed and exposed to sunlight and all bedding well aired and exposed to the sun.

In conclusion it might be well to emphasize the importance of a complete interdiction in the use of salt water on board ship when a necessity exists to prevent the spread of a water-borne infection which is easily transferred to and transmissible by food contamination.

U. S. S. "MARYLAND" REPORT

During the recent fleet concentration in the Caribbean Sea and the West Indies, dysentery developed aboard some of the vessels participating. Forty-nine cases were observed aboard the U. S. S. *Maryland*. The cases were all of a mild nature and the series is too small to constitute material for an epidemiological study, but a brief report of the epidemic may be of value in conjunction with reports from other vessels. The cases were characterized by griping abdominal pains, moderate prostration, sharp rise in temperature to from 103 to 104.5° F., and diarrhea with blood, mucus, and pus in the watery stools. The average number of sick days was between three and four. In a series of seven cases selected at random the dysentery bacillus of Flexner was identified in the laboratory aboard the U. S. S. *Relief*.

The first case to appear aboard this vessel developed while the ship was in Port of Spain, Trinidad, in a Hospital Corps man, who had, within 24 hours, been transferred from a ship where an epidemic of dysentery was established. The case was so mild and of such short duration that a diagnosis of enterocolitis was made. In

light of subsequent experience this is considered to have been in error. The character of the disorder in this case was identical with subsequent cases in which a diagnosis of bacillary dysentery was established by laboratory procedure.

No other cases appeared aboard this ship until April 20, two days after the ship had been at anchor in Guantanamo Bay in company with other ships of the fleet. During the next 10 days, new cases appeared daily as follows: 13, 7, 4, 3, 4, 3, 2, 5, 1, 4. On the last date, April 30, the fleet departed from Guantanamo Bay en route for New York. One case developed four days later. No further cases have appeared during the subsequent three weeks.

The man who was attacked by the disorder on April 20 had been swimming in the bay at the recreation landing on Hicacal Beach. At about this time the junior officer making this report was assigned to patrol duty at this beach and found the beach and water grossly contaminated with human feces. The matter was reported to the proper authorities and the use of the beach for swimming was discontinued. Efforts to trace definitely subsequent cases to a common source of infection were unsuccessful. Cases appeared with equal frequency among men who had and men who had not been swimming in the waters of the bay.

The fresh-water supply had not been altered, all such water being evaporated from sea water and none other having been taken aboard. This water was not examined bacteriologically at the time, but had been examined a short time before, while the ship was at anchor in the contaminated water of San Pedro Harbor and found to be free from contamination.

The food supply was carefully examined. All fresh provisions purchased in this area were thoroughly cooked before being served. Similar foods from the same sources were still in use aboard ship when the epidemic subsided.

The question of exposure ashore was considered. Liberty at Guantanamo City was being granted at this time, but none of the men affected had participated in these liberty parties. All cases save one, a warrant officer, appeared among enlisted personnel. The use of sea water for scrubbing mess tables and clothing was discontinued, but sea water was nevertheless still used, unavoidably, for certain purposes such as scrubbing decks. It should be noted that there is very little tidal current in this bay into which sewage from a population of some 40,000 or 50,000 was being dumped.

Measures taken to control the epidemic were based largely upon the assumption that the infection was being transmitted aboard ship by infected persons. The food supply and its preparation was carefully supervised, scuttle butts were flamed frequently, and all known cases were carefully isolated. A large number of men were

known to be infected but not ill enough to seek medical aid. Accordingly buckets of antiseptic solution were placed in all of the heads, and a watch posted to see that the men washed their hands thoroughly before leaving the heads. In particular, all men handling food were watched and isolated on the first appearance of infection.

In conclusion, it would appear from the meager evidence of this small series that so far as this vessel is concerned the water of the bay constituted the most likely source of infection. The evidence is inadequate, and a more extensive survey of the situation in the whole fleet would appear to be indicated.

SUBMARINE DIVISION 12 REPORT

Submarine Division 12 comprises the following vessels: U. S. S. *Bushnell*, tender, and submarines U. S. S. *S-3*, *S-6*, *S-7*, *S-8*, and *S-9*, having a combined average complement of about 450 men.

The division operated as a unit, and during the months of March and April the itinerary was as follows: Left Coco Solo, Canal Zone, March 4, 1930; arrived Guantanamo, March 7; left Guantanamo, March 27; arrived St. Thomas, Virgin Islands, March 30; left St. Thomas, Virgin Islands, April 7; arrived San Juan, P. R., April 7; left San Juan, P. R., April 14; arrived Guantanamo, April 18; left Guantanamo, April 26; arrived New London, Conn., May 2.

Cases of dysentery occurred as follows:

	March	April
U. S. S. <i>Bushnell</i>	0	4
U. S. S. <i>S-3</i>	1	4
U. S. S. <i>S-7</i>	0	3

Submarines *S-6*, *S-8*, and *S-9* escaped infection.

The outbreak began on board the U. S. S. *S-3* about 12 hours after arrival at St. Thomas, Virgin Islands, and four days after leaving Guantanamo. The first case occurred on March 31, two on April 1, and two on April 2. No other cases occurred on the *S-3*. It is interesting to note that one of the cases which occurred on April 1 was a ship's cook. The three cases from the *S-7* occurred as follows: One on April 5 while at St. Thomas, one each on April 11 and 14 while at San Juan, P. R. Of the four cases on the U. S. S. *Bushnell*, three developed while at San Juan, P. R., one each on April 8, 11, and 12, and the fourth on April 17 while en route from San Juan to Guantanamo.

Clinically the cases began with chilliness, general malaise, fever, and abdominal cramps. Dysentery was well established a few hours after the onset. Fever was a constant symptom and in one case was 103.8. Three officers were affected, and their symptoms seemed to be more severe than those of the enlisted men.

Stools from all cases were cultured at the United States naval hospital, St. Thomas, Virgin Islands, or at the School of Tropical Medicine at San Juan, P. R., and were reported positive for dysentery bacilli (Flexner type).

Four cases of enteritis and one case of gastroenteritis occurred during April. Stools from the four cases of enteritis were reported negative for dysentery bacilli by the School of Tropical Medicine at San Juan. No stool was cultured from the case of gastroenteritis, but the absence of classical symptoms seemed sufficient to rule out dysentery.

A supply of antidysenteric serum was obtained from the Lederle Agency at San Juan and was administered intravenously in five cases. Twenty cubic centimeters were given every 12 hours for three or four doses, and the results were most gratifying.

The engineering log of the *Bushnell* shows that no water was taken directly from Gatun Lake during the transit of the canal. Fresh water was taken on board while at Coco Solo, Canal Zone, prior to departure, and no further water was received from shore until arrival at San Juan, P. R., when the tanks on the *Bushnell* were again replenished.

The submarines also received fresh water from shore at Coco Solo, but all subsequent supply was received from the *Bushnell*.

The distilling apparatus on the *Bushnell* is of the low-pressure type. The temperature of the water in the evaporators ranges from 140° to 190° F. in a vacuum of from 22 to 24 inches. At the time of the outbreak the possibility of water contamination was not seriously considered, inasmuch as three submarines, having the same water supply as the infected units, escaped infection. Investigation of the water supply at both Coco Solo and San Juan showed no evidence of contamination. No bacteriological examination of the ship's water was attempted.

The possibility of infection having occurred as the result of swimming was considered, and swimming call was discontinued at the beginning of the outbreak.

All cases from the submarines gave a history of swimming over the side at Guantanamo, but none of those affected on the *Bushnell* had answered swimming call. One of the cases on the *Bushnell* had bathed at the officers' beach in St. Thomas two days before onset. The possibility of the infection on the *S-3* having resulted from swimming in Guantanamo Bay must be considered, inasmuch as the outbreak on that vessel occurred within five days after the departure from Guantanamo.

The first cases on the *S-7* and *Bushnell* occurred more than 10 days after departure from Guantanamo and could not have been connected with swimming in that port.

No fresh fruits were received on board in Guantanamo, but both fresh fruits and vegetables were received on board at St. Thomas and San Juan. There is no reason to believe that these had anything to do with this outbreak.

Flies were very numerous on all ships of the division and should be considered as among the possible causes.

The methods of control employed consisted of special sterilization of mess gear, scrubbing mess tables and benches in fresh water and drying in the sun, sterilization of hands of all men after defecation and before eating, frequent disinfection of toilet seats, and isolation of all suspects. It is believed that the efficiency of control measures was proved by the small number of cases and the prompt cessation of the outbreak.

The response of those cases treated with antidysenteric serum was most gratifying, and it would seem advisable that all ships be provided with the serum prior to departure for southern waters.

While the majority of cases in this outbreak were mild in character, it should be remembered that more virulent types may occur in future fleet concentrations, and it is believed that the control of a serious epidemic would be greatly aided by having a quantity of the serum on hand.

U. S. S. "RELIEF" (HOSPITAL SHIP) REPORT

A large number of cases of acute gastrointestinal disturbances occurred in the fleet while operating in southern waters in the spring of 1930. The diagnosis of dysentery, bacillary (Flexner type), was established in a certain number either by cultural characteristics or by fecal smear (cytology). Further serologic identification was made by the Hygienic Laboratory, Washington, D. C. The general procedure was then to consider as dysentery all cases that were clinically similar to those in which a positive diagnosis had been made.

The chronology of the onset of our own cases was as follows:
Left San Diego, Calif., February 15, 1930.

1 gastroenteritis, acute..... Feb. 23.

Arrived Canal Zone, February 27; left Canal Zone, March 10;
arrived at Guantanamo Bay, Cuba, March 15.

2 enterocolitis, acute..... Mar. 23.

2 enterocolitis, acute..... Mar. 25.

1 enterocolitis, acute..... Mar. 26.

2 enterocolitis, acute..... Mar. 27.

7 enterocolitis, acute..... Apr. 1.

Left Guantanamo Bay, April 2.

1 enterocolitis, acute..... Apr. 2.

1 enterocolitis, acute..... Apr. 3.

Arrived at Norfolk, Va., April 6; left Norfolk, April 14.

1 enterocolitis, acute..... Apr. 17.

Arrived at Guantanamo Bay, April 18; left Guantanamo Bay, April 19; arrived at Santiago, Cuba, April 19.

1 enterocolitis, acute..... Apr. 20.

Left Santiago, April 21; arrived at Guantanamo Bay, April 21.

1 enterocolitis, acute..... Apr. 23.

Left Guantanamo Bay, April 30.

1 enterocolitis, acute..... Apr. 30.

1 enterocolitis, acute..... May 1.

1 enterocolitis, acute..... May 2.

1 dysentery, bacillary..... May 2.

Arrived at New York, N. Y., May 7.

In addition to these 24 patients from its crew, the U. S. S. *Relief* received 45 from other ships, 37 of whom were given the diagnosis of bacillary dysentery. These 37 patients came from the U. S. S. *West Virginia*, U. S. S. *Mississippi*, U. S. S. *California*, U. S. S. *New Mexico*, U. S. S. *Tennessee*, U. S. S. *Camden*, U. S. S. *Procyon*, and U. S. S. *Robin*. There doubtless were other cases among our own personnel whose symptoms were mild and who did not report for treatment. We endeavored to minimize this number by a talk with the crew and by the aid of the division officers.

We tried to limit the diagnosis of bacillary dysentery to those in whom it could be proved by laboratory procedures, inasmuch as we had adequate facilities, but our results were positive in but one case. The press of work was great and our studies were, perforce, not as complete as we desired. One was entered as gastroenteritis, acute, and 22 as enterocolitis, acute. One of the latter was very mild, and the diagnosis was differential as against acute appendicitis. With this one exception, all the cases were clinically similar to the mild bacillary dysentery present in the fleet, and, without laboratory investigation and in the presence of the general outbreak, they would probably have been considered as dysentery. One case of acute enterocolitis showed pus cells in the feces and could reasonably have been called bacillary dysentery, although four cultures were negative.

All but two of our cases were cultured, and a record was made concerning blood in the feces in 23 and concerning pus cells in 19. One culture was positive for *Eberth. paradysenteriae*, but the others were negative for the pathogens concerned in food poisoning and dysentery. Red blood cells were present in two cases and pus cells in one.

These findings in connection with the feces were in distinct contrast to the results of examination of the cases of bacillary dysentery admitted from other ships, 57 per cent of whom yielded positive cultures of Eberth. *paradysenteriae*, 65 per cent had blood in the feces, and 65 per cent had pus cells in the feces. Both positive culture and pus cells were encountered in 43 per cent. Seventeen stools submitted from the U. S. S. *Maryland* showed positive culture in 47 per cent, blood in 47 per cent, pus cells in 53 per cent, and both positive culture and pus cells in 35 per cent. all on only one examination.

Inasmuch as we did not believe that we were dealing with bacillary dysentery, we endeavored to ascertain the cause of the outbreak on this ship. Various possible etiologic factors were investigated, but no satisfactory conclusion was reached.

Our cases were disseminated over a period of about 10 weeks, the greatest concentration (16 cases) developing between March 23 and April 3. The patients were derived from commissioned officers, chief petty officers, and widely varied lower ratings, and separate messes were involved. There was no contiguity that would reasonably account for the spread of an infection.

Food poisoning was considered, but this supposition was dismissed. Cultures of feces had been uniformly negative for the bacteria associated with such cases. Investigation showed that the foodstuffs and their handling were not open to question. There was no grouping of cases, such as occurs when food poisoning is responsible.

Drinking water was a possibility. Previous naval experience with outbreaks of this type associated with Guantanamo Bay and Gatun Lake were recalled, as well as the question of efficient sterilization of water during distillation. No fresh water was taken on board during the cruise except at Norfolk, and our supply was maintained by distillation. The chief engineer stated that the evaporators were operated only in single effect, and that the coil temperature did not fall below 216° F.; the plant was not pushed, and the salt content of the distilled water did not rise at any time above 0.8 grain per gallon. Our distilling plant was operated only for boiler feed while transiting the Panama Canal. Culture of our tap water on March 28 showed no growth.

We also made bacteriological examinations for other ships. No gas formers were found in four samples of water from the U. S. S. *Camden* on March 15 or in a sample of ice on March 24. Two samples of water from the U. S. S. *Oglala* were negative for gas formers on March 25. Samples of water and ice cream from the U. S. S. *California* were negative for dysentery bacilli and gas formers on April 18. The fleet canteen submitted two bottles of soft drinks that had been purchased locally, and no gas formers were found.

It is generally recognized that Guantanamo Bay is intensively polluted by sewage during a fleet concentration. Being bordered by numerous tortuous lagoons, the tides and currents can not cleanse it effectively. Gross feces are visible from the ship at most any time. There was undoubted contamination from the ships with bacillary dysentery. We cultured the water for gas formers which were identified on March 26 as *Escherichia coli* with the following results:

	Mar. 26	Mar. 28	Mar. 31
Alongside ship (berth 25).....	Positive.....		
At about 450 yards from ship, bearing 335 degrees, where our swimming buoys were anchored.....	do.....	Negative.....	
At beach adjacent to preceding.....	do.....		
At swimming dock at the Officers' Club.....		Negative.....	Negative.....
At boat landing at Officers' Club.....		Positive.....	Do.....

Most of the fleet had been out of the bay on March 27 and 28.

There was ready contact with the polluted water of the bay. Swimming from this ship was permitted at the buoys mentioned above until March 26, then shifted to the mouth of Eagle Channel, and stopped on April 2, except that no restriction was placed on swimming at the Officers' Club. All bathing facilities on this ship are supplied with fresh water, but the heads have salt-water faucets, and salt water was extensively used for cleaning, including mess tables. Passengers in small boats were often wet by spray. To incriminate this polluted water, however, would imply a bacterial infection, and this we were not able to prove even after careful work, except in our one case of bacillary dysentery. Nor would it account for our first case.

We harbored cases of dysenteric type from other ships beginning on March 17. These were isolated, and the usual precautions observed by their attendants. None of the Hospital Corps men on duty in the wards were infected, although they were in intimate contact with the sick for weeks. But an acute enterocolitis developed in three of their outside assistants, one of whom was on sentry duty at the head of the exit ladder, one carried diets to the ward, and one carried linen from the ward to the disinfector. These three cases appeared on April 20, April 30, and May 1, and we were not able to prove bacillary dysentery in them by laboratory procedures. They had, apparently, observed reasonable precautions. With these three possible exceptions, there was no evidence of the spread of infection from our isolated cases.

How our one patient with bacillary dysentery was infected is a question. He was a fireman, third class, on messman duty, and had no association with other cases. We suspected the contaminated water from the bay through its use for cleaning or in the engineer's washroom. The precautions instituted for this division were rinsing the hands in 0.5 per cent liquid cresolis compound on leaving the

head and washroom, messmen to follow the same procedure on assuming and finishing duty, and daily sunning of mess tables. No further cases developed.

We failed to establish a satisfactory etiology for our outbreak. Several unconvincing surmises might be made, one being exposure to tropical heat and sunlight when unaccustomed to them. None of our cases developed except in southern waters. With this background there might enter such exciting factors as alcoholic beverages, excessive ingestion of water, tropical fruits, strenuous exercise, and chilling while sleeping on deck. One patient had consumed considerable iced water while on duty in the fireroom. No one determined exciting factor held, however, for all cases.

GENERAL CONSIDERATIONS

The period of the epidemic may be said to extend roughly from March 15 to May 1 with its peak of incidence about April 17 to April 25.

About 30 ships of the Scouting Fleet had made more or less prolonged visits in Guantanamo Bay during the period from January 13 to February 24 (the *Wright* as late as February 22 to March 7). Swimming over the side in the bay was allowed and general liberty was given, both officers and enlisted personnel visiting Guantanamo City. Moreover, vegetables and fruits acquired ashore in Caimanera were used by all ships. In short, at that time everything was done that was done later when the combined fleet assembled, and yet no cases of bacillary dysentery had occurred on these ships as late as March 29.

The first ship of the combined fleet to develop an increasing incidence of the disease was the *Camden*¹ (initial case February 16). She was on the Atlantic side of the Isthmus (Coco Solo) from January 20 to March 4. Her individual epidemic comprising 77 cases (11 were readmitted) of bacillary dysentery and 15 cases of acute enteritis or gastroenteritis began while she was still at Coco Solo and reached its height March 24, when 19 cases were admitted or readmitted (8) 17 days after arrival at Guantanamo. By this date she had admitted a total of 47 cases of bacillary dysentery plus 9 readmissions and 5 acute enteritis or gastroenteritis. The larger proportion of new case admissions was in groups of from 2 to 11. The final total for dysentery and acute diarrheal disorders was 92, and of this number 26 were admitted from the submarines (*S-18*, *S-21*, *S-22*, *S-23*, and *S-48*) attached to the *Camden*. In addition, there were two admissions with carrier, dysentery, bacillary. Neither patient showed any symptoms of the disease other than a

¹ *Camden* is used in a collective sense, embracing her group of submarines.

positive culture of feces for the Flexner bacillus. The *Camden* had passed through the canal on January 20. Reference will be made later to the epidemic of bacillary dysentery in the Fourteenth Infantry in the Canal Zone.

*Ships having cases of dysentery or other gastrointestinal disorders*¹

BATTLE FLEET

Ship	Date, first case, dysentery	Total dysentery	Date, first case, other gastro-intestinal diseases	Total gastro-intestinal diseases	Total all cases
Antares ^{2 3}			Mar. 25	4	4
Arctic ^{4 5}			Apr. 23	1	1
Argonne ^{4 5}			Mar. 23	5	5
Aroostook ^{4 5}			May 15	1	1
California ^{4 5}	Apr. 2	244	Mar. 15	4	248
Colorado ^{4 5}			May 2	3	3
Idaho ^{5 6}			Apr. 22	3	3
Langley ^{4 7}			Apr. 2	12	12
Lexington ^{4 5}			Apr. 1	3	3
Maryland ^{4 5}	Apr. 21	45	Mar. 12	8	53
Mississippi ^{4 5}	Mar. 21	82			82
Neches ^{4 5}			May 1	2	2
New Mexico ^{4 5}	Mar. 24	145	Mar. 8	2	147
New York ^{4 5}			do.	9	9
Oklahoma ^{5 5}	Apr. 29	2	Apr. 4	3	5
Pruitt ^{4 5}			Apr. 1	3	3
Relief ^{4 5}	Mar. 23	2	Mar. 25	21	23
Saratoga ^{4 7}			Apr. 6	5	5
Sicard ^{4 5}			Apr. 10	1	1
Tennessee ^{4 5}	Apr. 12	1	Mar. 23	9	10
Vestal ^{2 5}	Apr. 10	1	Mar. 10	20	21
West Virginia ^{4 5}	Apr. 12	82	Mar. 11	15	97
Total, Battle Fleet		604		134	738

SCOUTING FLEET

Arkansas ^{5 5}			Mar. 30	13	13
Barry ^{2 3}			Mar. 25	1	1
Bushnell ^{2 3}	Apr. 8	4	Apr. 1	4	8
Camden ^{4 5}	Feb. 16	62	Feb. 21	6	68
Cincinnati ^{2 3}			Mar. 13	4	4
Concord ^{2 3}			do.	1	1
Detroit ^{2 3}			Mar. 27	1	1
Dobbin ^{2 3}			Mar. 28	11	11
Humphries ^{2 6}			Mar. 22	1	1
Marblehead ^{5 5}			Mar. 26	2	2
Memphis ^{5 5}			May 1	1	1
Oglala ^{4 5}	Mar. 29	24	Apr. 7	2	26
Pensacola ^{4 6}			Mar. 8	2	2
Richmond ^{5 5}			Mar. 19	4	4
Utah ^{5 5}			Mar. 21	1	1
Wright ^{2 3}			Mar. 22	5	5
Wyoming ^{5 5}			Apr. 25	2	2
S-3 ^{5 5}	Mar. 31	5	Mar. 20	2	7
S-7 ^{5 5}	Apr. 5	3	May 19	1	4
S-9 ^{4 5}			Apr. 26	1	1
S-18 ^{4 5}	Mar. 31	3			3
S-21 ^{5 5}	Mar. 26	3			3
S-22 ^{5 5}			Apr. 24	1	1
S-23 ^{5 5}	Apr. 5	1			1
S-48 ^{5 5}	Mar. 12	7	Mar. 12	1	8
Total, Scouting Fleet		112		67	179

¹ The figures included in this survey are tentative, as the complete statistics are not available until the last of calendar year.

² Did not contact Canal Zone.

³ In Guantanamo Bay.

⁴ Passed through canal.

⁵ Contacted the Canal Zone.

⁶ Not in Guantanamo Bay.

⁷ In Guantanamo area, but not in bay.

Ships having cases of dysentery or other gastrointestinal disorders—Continued

MISCELLANEOUS SHIPS

Ship	Date, first case, dysentery	Total dysentery	Date, first case, other gastro- intestinal diseases	Total gastro- intestinal diseases	Total all cases
Denver ⁴			Mar. 22	12	12
Galveston ⁵ ⁶			Apr. 8	2	2
Hannibal ² ⁶			Apr. 4	2	2
Rochester ⁴ ⁵			Apr. 9	1	1
Sacramento ⁴ ⁶			Mar. 11	1	1
Texas ⁴ ⁵			Mar. 13	4	4
Total, miscellaneous ships.....				22	22

² Did not contact Canal Zone.⁵ Contacted the Canal Zone.³ In Guantanamo Bay.⁶ Not in Guantanamo Bay.⁴ Passed through canal.

All dates above are within the epidemic period, except that of the *Camden*. In the case of the *Camden* the date of the beginning of her series of cases is given because she is considered the origin of the epidemic.

It may be ascertained from the above table that—

I. Eighteen ships of the Battle Fleet passed through the canal; 4 ships of the Battle Fleet visited the Canal Zone; 2 ships of the Battle Fleet did not visit the Canal Zone; 7 ships of the Scouting Fleet passed through the canal; 15 ships of the Scouting Fleet visited the Canal Zone; 10 ships of the Scouting Fleet did not visit the Canal Zone; 4 miscellaneous ships passed through the canal; 2 miscellaneous ships visited the Canal Zone; 1 miscellaneous ship did not visit the Canal Zone. Fifty of the ships having cases of bacillary dysentery or other diarrheal disorders visited the Canal Zone and gave general liberty, except possibly the *Artic* and *Chaumont*. Eleven of the ships having cases of bacillary dysentery or other diarrheal disorders did not visit the Canal Zone.

The period involved in these contacts with the Canal Zone is January 12 to March 10, except for the *Colorado* and *Pensacola*, which visited the Canal Zone between April 8 and 21. With two possible exceptions (*Arctic* and *Colorado*) the contacts were long enough for general liberty, not less than one week. The *Colorado*, however, did give general liberty.

II. Twenty-one ships of the Battle Fleet were in Guantanamo Bay; 2 ships of the Battle Fleet were in Guantanamo area; 1 ship of the Battle Fleet was not in Guantanamo area; 29 ships of the Scouting Fleet were in Guantanamo Bay; 3 ships of the Scouting Fleet were not in Guantanamo area; 3 miscellaneous ships were in Guantanamo Bay; 4 miscellaneous ships were not in Guantanamo area. Fifty-five of the ships having cases of bacillary dysentery or

other diarrheal disorders were in the Guantanamo area, and all of these but two were in Guantanamo Bay. Eight of the ships having cases of bacillary dysentery or other diarrheal disorders were not in the Guantanamo area.

The period involved in the presence within the Guantanamo Bay area, specifically at anchor in Guantanamo Bay, exclusive of the uninvolved January visit of ships of the Scouting Fleet above mentioned, is roughly March 3 to April 30. The *Arkansas*, *Barry*, and *Concord* were there earlier, but this fact, like that of the January visit of other ships of the Scouting Fleet, enters into our problem in a negative way only as suggesting that the source of infection was absent at this earlier period. As regards the later Guantanamo period, many of the ships were in and out in connection with exercises and, on one occasion, visiting different ports for liberty.

III. (a) The ships having cases of bacillary dysentery or other diarrheal disorders and which did not visit the Canal Zone are:

Battle Fleet: *Antares* and *Vestal*.

Scouting Fleet: *Barry*, *Cincinnati*, *Concord*, *Detroit*, *Dobbin*, *Milwaukee*, *Sturtevant*, *Wright*, and *Falcon*.

(b) The ships having cases of bacillary dysentery or other diarrheal disorders which were not in the Guantanamo area during the epidemic period are:

Battle Fleet: *Idaho*.

Scouting Fleet: *Pensacola* and *S-20*.

Miscellaneous ships: *Denver*, *Galveston*, and *Sacramento*.

All ships having cases of bacillary dysentery or other acute diarrheal disorder, except those enumerated under III (a) and (b), visited both the Canal Zone and Guantanamo area. The number of ships diagnosing cases of one or another of these diseases which did not visit the Canal Zone but which did visit Guantanamo Bay area are 11, as compared with 6 ships of the reverse history. All ships of the fleet which developed cases of bacillary dysentery in other than sporadic incidence were present in the Guantanamo Bay area during the period of the epidemic.

Bacillary dysentery is endemic in Panama territory contiguous to the Canal Zone and the waters of the bays on the Atlantic and Pacific sides of the Isthmus are polluted. The week ending February 8 the Fourteenth Infantry, United States Army, in camp at Corozal, Canal Zone, admitted 147 cases of bacillary (Flexner type) dysentery. This regiment had crossed the Isthmus and gone into camp on January 20 and remained in Corozal until February 5, on which date companies A, B, C, E, F, G, I, K, and L started on a 100-mile march into the Republic of Panama, returning February 17,

and Companies D, H, and M started on a 100-mile march in the Canal Zone, occupying camp when not on this march. The epidemic is considered to have had its origin in a carrier or unrecognized cases, and flies are believed to have played an important part in dissemination; possibly also the dust (it was the season of high winds) from a near-by Chinese garden, although such gardens are carefully supervised by the sanitary department of the Canal Zone. Some of the cases were severely ill, but not dangerously so, and, on the whole, the symptoms were mild. Many cases were not clinically dysentery but were so diagnosed because associated with cases which were typical clinically. The 107 cases transferred to Gorgas Hospital were all cultured for the dysentery bacillus and 36, or 34 per cent, were positive. Those not positive were changed to enterocolitis, but all cases sent to the station hospital at Corozal with a diagnosis of dysentery were continued with that diagnosis. Although 29 additional cases developed in the course of the month (February) making a total of 173 cases, the epidemic rapidly declined when the troops left camp on these marches and rigid preventive measures had been inaugurated.

This occurrence has been presented rather fully because its development and decline and nature in detail, including organism, conform rather closely, allowing for differences in service conditions, to the epidemic in the fleet.

LOCAL CONSIDERATIONS

The epidemic was unquestionably one of bacillary dysentery in the main as evidenced by positive laboratory determination in a wide range of cases, representative of all ships concerned. The diagnosis and causative agent, when adequate laboratory diagnostic facilities were lacking, were sufficiently indicated early in the epidemic by the classical symptoms and signs of outstanding cases and from the prompt beneficial results obtained from the use of polyvalent antidysenteric serum.

The disease did not appear in the Scouting Fleet on the occasion of its January, 1930, visit to Guantanamo Bay nor later, except for the *Camden* and her submarines, the *Bushnell* and her submarines, and the *Oglala*. As, with the exception of the *Camden* and her submarines, the epidemic incidence of the disease on the different ships did not occur until varying periods after the combined fleet had assembled in Guantanamo Bay, we may exclude from further consideration in this survey the six ships which did not visit the Guantanamo area. They represent a very small number of cases, absolutely as well as relatively, and the infection was probably acquired ashore in any of several ways, as happened with

the initial case in the Army epidemic and on the *Camden*. At any rate, they seem of no importance and are conceived to have no connection with the matter in hand.

The disease was not confined to any particular class or group or mess aboard ship; nor was any such group or mess infected in anything like entirety—a few cases only here and there in each physical group. There was, however, a preponderance of cases in certain groups to be mentioned later which is suggestive and perhaps significant.

In all probability, many mild cases did not go to the sick bay, as is usual in extensive mild epidemics, and among those that did seek treatment early in the history of the epidemic and even later the nomenclature for one of the acute diarrheal affections was employed to express the diagnosis. It is impossible to draw the line under such circumstances without cultural examination (it frequently takes successive cultures to get a positive finding; a negative finding does not exclude dysentery), but there were probably some cases entitled to the simpler diagnosis. On the other hand, cases of true dysentery were undoubtedly missed. Speaking symptomatically, in many of them perhaps the affection did not give that picture of typical dysentery which we ordinarily look for, but in this respect the cases on the *New Mexico*, for example, were no different from the great preponderance of cases on other ships. Though extensive in number of cases and ships involved, the epidemic was mild, and there were no deaths. But it is not reasonable to suppose that so striking an incidence of what from all appearances was a given malady throughout the fleet (or on any one ship for that matter) at the same place over a definite range of time without explosive occurrence (a varying number of cases appearing in different messes and class groups day after day) could be anything but a definite communicable disease with a more or less common source of infection.

The experience of the *Tennessee* may be cited in justification of the belief that bacillary dysentery was more widespread than the original diagnostic record would indicate. All of her cases were mild, and none exhibited the usual symptoms of frank dysentery, such as bloody and mucous stool, tenesmus, etc., but were apparently typical cases of simple acute enteritis. Of the *Tennessee's* 40 cases, 21 were not admitted to the sick list. Of the 19 admitted, 6 were treated and returned to duty aboard ship before reaching New York and 13 were transferred to hospital upon arrival in New York with a diagnosis of enteritis, acute. This transfer was necessary—not because the condition of the patients required it, but because the ship went into dry dock. The interesting fact in connection with all this is that the Flexner organism was demonstrated in 9 of the 13 cases so transferred rather late in their illness.

Changes in diagnosis made on ships

Ship	Changed from—	Changed to—	Number of cases
California.....	Gastroenteritis.....	Bacillary dysentery.....	20
Do.....	Gastritis.....	do.....	1
Camden.....	Gastroenteritis.....	do.....	2
Do.....	Enteritis.....	do.....	15
Mississippi.....	Gastroenteritis.....	do.....	5
Do.....	Enteritis.....	do.....	29
New Mexico.....	Gastroenteritis.....	do.....	145
S-48.....	Enteritis.....	do.....	2

On most ships cases admitted before the true nature of the disease was suspected or determined were discharged to duty when physically well and quite naturally without provision for the protection of others either directly or indirectly from the menace of a carrier state. Later in the course of events this omission was partially corrected, but until the epidemic was well established measures of control were based largely upon the assumption that the infection was being transmitted aboard ship by infected persons. These measures did not serve markedly to protect the personnel of the *Oglala* or other ships. The *Oglala* is especially mentioned because she was anchored close to the *Camden*, and because of the known cases on the *Camden* the *Oglala* inaugurated very strict and thorough precautions. This was 10 days before the appearance of the disease on the *Oglala* (March 29). They consisted of everything possible to prevent contact or otherwise carrier infection on board (the stools of cooks, messmen, bakers, and laundrymen were examined to detect carriers but with negative results), but at that time the epidemic in the fleet had not developed and other possible means of dissemination was not thought of.

The *West Virginia* visited Port of Spain, Trinidad, where bacillary dysentery is said to be endemic, but except for one case (the first) none of the nine cases developing there could be traced to the slightest possibility of shore infection. She had left Guantanamo Bay April 2 and arrived at Port of Spain on April 5. The case developing in the surgical ward of the *Relief* is a clear example of at least six days' incubation period.

The first case on the *Tennessee* occurred April 6 while en route to Port of Spain, after having spent the two preceding weeks at anchor in Guantanamo Bay.

The first case on the *Maryland* also made its appearance at Port of Spain, but it was in a Hospital Corps man who had within 24 hours been transferred from a ship on which the disease had already become epidemic. No other case developed until two days after the

Maryland's return to Guantanamo. She arrived back there on April 18 and on April 20 one case was admitted, and on each of the succeeding 10 days from 1 to 13 new cases appeared, a total of 48 up to April 30. On this date the ship departed for New York and only one more case developed (May 4). The man admitted on April 20 had been swimming in the bay at recreation landing on Hicacal Beach, and the water in that locality was found to be grossly contaminated with human feces.

Many of the ships were granting liberty to visit Guantanamo City, but the *Maryland* definitely states that none of her men coming down with dysentery had participated in these liberty parties. Though perhaps with a less per cent of definiteness, other ships are similarly able to acquit shore liberty at Guantanamo of any connection with the dysentery incidence.

Cases of the disease appeared on all ships participating with approximate equal frequency among men who had and men who had not been swimming in the bay and serious consideration came to be given to the harbor water as at least one of the sources of infection. All cases on the submarines gave a history of swimming over the side. There is very little tidal current in Guantanamo Bay into which, with about 60 ships present, the sewage from a population of some 40,000 or 50,000 was being dumped. The bay was visably fouled with excreta and the hospital ship had convicted various parts of the bay of pollution bacteriologically. No disinfection of sewage of ships was practiced or possible.

EXPLANATION OF ACCOMPANYING CHART OF GUANTANAMO BAY

The conjectural course of the current in ebb tide is indicated by the arrowed line.

The ships having dysentery are named, showing berths and chronological order of participation in epidemic.

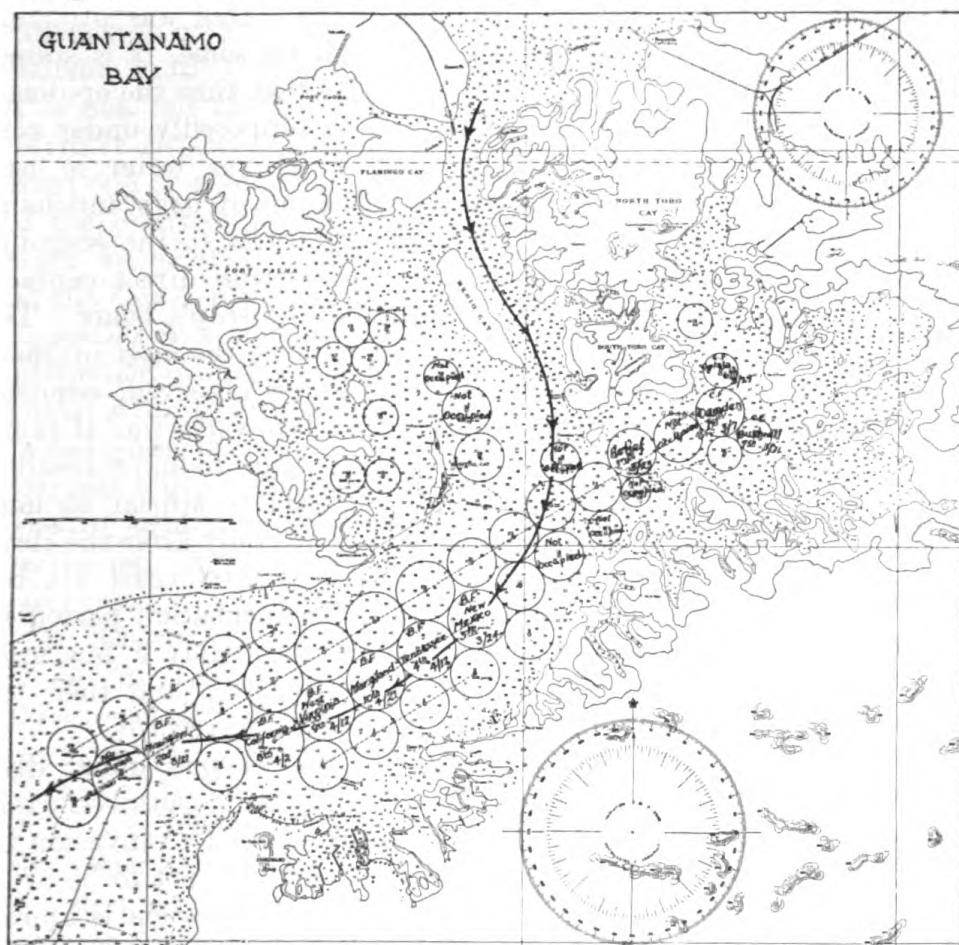
The berths not occupied are also indicated; all other berths were occupied, 28 to 33 (inclusive), 16 to 24 (inclusive), 35 and 46 to 50 (inclusive), by ships of the Scouting Fleet.

In the case of the *Camden* the date shown is date of arrival (first case while at Colon, Canal Zone, being 2-16).

Anchorage	Name of ship	Fleet	Inclusive dates	
			March	April
No. 1.....	U. S. S. Texas.....	United States Fleet (Flag).....	16-23, 29-30	19-29
No. 2.....	U. S. S. Arkansas.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 3.....	U. S. S. Florida.....	do.....	16-23, 29-30	19-29
No. 3.....	U. S. S. Relief.....	Battle Fleet.....	16-23, 29-30	22-29
No. 4.....	U. S. S. Utah.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 5.....	U. S. S. Argonne, Submarine Division 20.....	Battle Fleet.....	16-23, 29-30	19-29
No. 6.....	U. S. S. Salt Lake City.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 7.....	U. S. S. California.....	Battle Fleet.....	16-23, 29-30	19-29
No. 8.....	U. S. S. West Virginia.....	do.....	16-23, 29-30	19-29
No. 9.....	U. S. S. Maryland.....	do.....	16-23, 29-30	19-29
No. 10.....	U. S. S. Tennessee.....	do.....	16-23, 29-30	19-29
No. 11.....	U. S. S. New Mexico.....	do.....	16-23, 29-30	19-29
No. 12.....	U. S. S. Procyon, Kingfisher, and Partridge.....	do.....	16-23, 29-30	19-29
No. 13.....	Not occupied.....	.....	.....	.....
No. 14.....	do.....	.....	.....	.....
No. 15.....	U. S. S. Mississippi.....	Battle Fleet.....	16-23, 29-30	19-29
No. 16.....	U. S. S. Wyoming.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 17.....	U. S. S. New York.....	do.....	16-23, 29-30	19-29
No. 18.....	U. S. S. Oklahoma.....	do.....	16-23, 29-30	19-29
No. 19.....	U. S. S. Nevada.....	do.....	16-23, 29-30	19-29
No. 20.....	U. S. S. Dobbin, with destroyers.....	do.....	16-23, 29-30	19-29
No. 21.....	U. S. S. Detroit.....	do.....	16-23, 29-30	19-29
No. 22.....	U. S. S. Raleigh.....	do.....	16-23, 29-30	19-29
No. 23.....	U. S. S. Cincinnati.....	do.....	16-23, 29-30	19-29
No. 24.....	U. S. S. Milwaukee.....	do.....	16-23, 29-30	19-29
No. 25.....	U. S. S. Relief, Brant, and Tern.....	Battle Fleet.....	16-31	1-2
No. 26.....	Not occupied.....	.....	.....	.....
No. 27.....	U. S. S. Camden, Submarine Divisions 3 and 4.....	Channel Fleet.....	7-23, 29-30	19-29
No. 28.....	U. S. S. Memphis.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 29.....	U. S. S. Marblehead.....	do.....	16-23, 29-30	19-29
No. 30.....	U. S. S. Richmond.....	do.....	16-23, 29-30	19-29
No. 31.....	U. S. S. Trenton.....	do.....	16-23, 29-30	19-29
No. 32.....	U. S. S. Wright, Sandpiper, and Teal.....	do.....	16-23, 29-30	19-29
No. 33.....	Air Squadrons.....	Battle Fleet.....	16-23, 29-30	19-29
No. 35.....	U. S. S. Concord.....	Scouting Fleet.....	16-23, 29-30	19-29
No. 36.....	Not occupied.....	.....	.....	.....
No. 38.....	U. S. S. Mallard, 2 ships Submarine Division 18.....	Channel Fleet.....	16-23, 29-30	19-29
No. 39.....	U. S. S. Bushnell, Submarine Division 12, and 2 ships Submarine Division 18.....	do.....	16-23, 29-30	19-29
No. 40.....	Not occupied.....	.....	.....	.....
No. 41.....	U. S. S. Oglala, Mine Division 1.....	Channel Fleet.....	16-23, 29-30	19-29
No. 42.....	U. S. S. Falcon, Quail, and Lark.....	do.....	16-23, 29-30	19-29
Nos. 43, 44, and 45.....	Destroyer squadrons.....	Battle Fleet.....	16-23, 29-30	19-29
Nos. 47-50.....	Destroyer Nest.....	Scouting Fleet.....	16-23, 29-30	19-29

The chart of Guantanamo Bay showing the berths of the particular ships affected and the dates of the appearance of dysentery on board each in connection with the conjectural path of the ebb tide current is interesting. The velocity of the tidal currents is but 0.2 knot in the channel at Fort Toro and 0.1 knot in the lower part of the bay, so that idle drifting, particularly in the inlets and between the tidal flow margin and shore on either side of the bay, even at times of tide movement, is not much interfered with. The sweep of the ebbing tidal current is from the north past the entrance of Granadillo Bay toward the southeastern side of the lower part of the bay, and thence toward mid-channel around Fisherman Point.

It will be seen that the *Camden*, *Oglala*, and *Bushnell* are anchored close together in Granadillo Bay and that the *Relief* was anchored in the entrance of that bay until April 2. The community of exposure of all three of these ships to the *Camden*, as the original source of infection, is apparent. The outflow from Granadillo Bay would be picked up, so to speak, by the ebbing tidal current and gradually carried and distributed to the lower southeastern



Position of ships during epidemic period

parts of the bay as indicated. Practically all of the ships affected were anchored in this path of distribution, not excluding the *Mississippi*, which was anchored almost directly abreast Fisherman Point. It is not difficult to explain why the Scouting Fleet, which was anchored on the opposite side of the channel, escaped infection. For this same reason, and because of the bank of colder and heavier sea water, it is probable that Hicacal Beach, while somewhat polluted by the ships on that side of the bay, did not carry the specific infection. Similarly the naval station side was probably protected by a bank of colder and heavier sea water entering the bay on the

east side and moving slower than and counter to the out-flowing warmed and lighter water from the upper bay.

Upon the return of the ships from visits to liberty ports (April 18) swimming over the side in Guantanamo Bay and the use of sea (harbor) water for scrubbing mess tables and clothing was forbidden. Swimming at Hicacal Beach was stopped two days later. Nevertheless, says the *Maryland*, sea water was still unavoidably used for certain purposes, such as scrubbing decks. This was probably also the case on many other ships, although on some, it is stated, all use of harbor water was discontinued. By that time the epidemic was either well under way on some ships or supposedly under control on others. The other purposes for which sea water is used aboard ship are shower baths and the scrubbing of bags and hammocks and, as may be recognized as quite natural to the seagoing man, there are many other accidental or otherwise direct contacts with sea water, such as in the handling of the ship's boats. The interdiction of swimming (a diversion constituting the most intimate form of contact), as far as the interdiction was observed, removed the most direct danger of infection, if the harbor water was at fault, and a definite moderation of the epidemic seems to have resulted from the interdiction; but new cases continued to appear as long as the ships remained at Guantanamo, and it was only after the ships had departed for home waters (New York or west coast via the canal) that the epidemic ceased. Within the incubation period of the disease from the date of leaving Guantanamo Bay a few mild cases scattered among the different ships occurred, and then the disease practically disappeared from the admission records.

Excessive heat, diet, and ship's life in the Tropics under drill and maneuver conditions may have been predisposing causes—factors in the lowered resistance of the gastrointestinal tract to invasion by bacteria—but these conditions are perennial and are not to be overweighted with responsibility when the malady in question is known to be a filth disease and occurs when sanitation is defective. Just where the defect or defects were is the matter for determination in this instance and always as a means to preventing recurrence.

Care of mess gear, foodstuffs (raw or cooked), and drinking and cooking water after careful consideration by all ships in connection with the epidemic are dismissed as playing no rôle in its causation. So, also, with flies; in the special reports received this usually important vector in filth diseases is mentioned but twice. They are characterized as few in numbers on the *California* and as numerous on the *Bushnell* and submarines.

SALIENT CONSIDERATIONS

In the first place, the elapsed time between the date of departure from the Atlantic side of the Isthmus and the appearance of first cases, whether of dysentery or some acute diarrheal affection, is too long to incriminate the Isthmus as the source of infection on the several ships, in spite of the fact that it is a source of infection, as pointedly shown, during the period under consideration by the experience of the Army. Bacillary dysentery is not considered endemic in the Canal Zone and the records justify the assertion that it is not, but the harbors at both ends of it are polluted and the territory adjacent to the zone is a ready source of infection. It was from one or another or both of these sources that the original cases of the Fourteenth Infantry probably received their infection; it is from one or another or both of these sources that the original cases on the *Camden* probably received their infection. At any rate, the *Camden's* infection came from some source off the ship, and it is altogether probable that this was not an infection of a single individual with dissemination on board the ship as an explanation of its initial cases, but a multiple person infection from the same or other original source. The possibility of the same source is logical to the idea of swimming and the known flocking of shipmates in seeking recreation, particularly in small communities with limited recreation resources.

In relation to the epidemic the *Camden* stands in separate case in several respects as previously pointed out and outstanding in these several respects are the facts; viz, that she was the first ship to develop the disease; that the disease had appeared and seven cases developed before she left the Canal Zone for Guantanamo on March 4; that, other than five or six ships of the Scouting Fleet already in the Guantanamo area, she was among the first few to arrive early for fleet concentration, and when she did reach Guantanamo Bay (March 7) 12 cases of dysentery had been admitted to the sick list. New cases continued to develop, two, three, or four a day, from contact with infected individuals or the harbor water of her own polluting, and before any other ship had shown any sign of joining the march of the epidemic (*Mississippi*, March 19) she had had 26 cases. The nature of the exposure to the harbor water as an agent in dissemination can be seen by those familiar with the activities of the fleet at anchor, such as the spray of motor barges and motor sailers under way; the swabbing of gunwales and thwarts, etc., in the cleaning of small boats; scrubbing of clothes, bags, and hammocks; scrubbing mess tables and benches; scrubbing of decks; in short, any manual use of the water, to say nothing of the more intimate contact incident to shower baths and swimming.

It is not to be inferred from the foregoing that other means of disseminating the infection are discounted. Flies and carriers and more or less direct accidental or careless contact with the sick or convalescent probably all played their parts in the messes and elsewhere, but enough has been said about the peculiarities of the epidemic incidence to stamp these agencies as minor. It seems largely a salt-water direct-to-mouth or a salt-water hand-to-mouth or hand-to-food dissemination, and hence the irregular manner of the appearance of the cases on the various ships and in the various messes, and its absence in some ships and retarded appearance on others. Contrary to finding the idea of harbor-water dissemination inconsistent with the characteristics of the epidemic incidence, its acceptance explains all the peculiarities observed. In this connection the preponderance of cases among those of greater normal contact with salt water (seaman and fireman branches) is interesting and somewhat corroborative in its suggestiveness.

The fleet surgeon's informally communicated observations have guided effectively in the foregoing review of the general and local considerations. His opinion is believed correctly reflected in the statement, (a) that bacillary dysentery is not or was not at the time endemic in the Guantanamo environs and that Guantanamo Bay is not natively infected with the *Bacterium dysenteriae*, and (b) that the origin of the epidemic was isthmian contact. The present reviewers subscribe to both of these opinions, but see much more in the harbor-water explanation under the circumstances of fleet concentration in Guantanamo Bay than he was able or disposed to find at the time. The assembled data may be more persuasive on this point. The hospital ship renewed its bacteriological examination of Guantanamo Bay water on March 28, which was after the harbor had been practically empty of ships for about 48 hours. Pollution was still evident, but in reduced degree, suggesting the benefit to be derived by the absence of ships in giving the bay an opportunity to free itself of infection.

CONCLUSIONS

The specific conclusions to which we are impelled are:

1. That a sufficient preponderance of the cases constituting the epidemic were of dysentery symptomatology and bacillary etiology to characterize the epidemic as one of bacillary dysentery.
2. That the original source of the infection was the Isthmus of Panama, and that the *Camden* conveyed it to Guantanamo and became the primary focus from which the disease spread. While there may have been an isolated individual here and there in the battle-ships originally infected on the Isthmus, the history in relation to incubation period does not warrant the acceptance of the idea as at all likely.

3. That various modes of contact dissemination may have been operative when the disease finally appeared on one after another of the several ships involved (the 51 admissions of members of the culinary force makes it a probable factor in dissemination), but that harbor water, through the enumerated forms of contact with it, especially shower baths and swimming, was the principal medium of spread, beginning with the specific type of pollution supplied by the effluent of the *Camden* alone and augmented by one ship after another as successive ships developed cases of the disease.

4. That whatever number or proportion of actual cases of enteritis, enterocolitis, or gastroenteritis a given ship may have had, the source of the exciting cause was the same and due to the same harbor-water pollution.

A similar experience in point of place, time of year, symptomatology, and epidemiology was had by the fleet in April, 1927, and was made the subject of interesting comment in the Naval Medical Bulletin of October, 1927, Volume XXV, No. 4, pages 1010-1017. This should be reread in the light of recent experience.

RECOMMENDATIONS

(A) As occasion requires in the presence of a case, but particularly increasing cases, of intestinal infection of the typhoid-enteritidis-dysentery group:

1. Tighten routine sanitary measures all along the line.
2. Where possible, have stools cultured in the interest of definite diagnosis, and don't be satisfied with one negative. Colony characteristics may be sufficient in successive cases after the nature of an intestinal infection has been determined, and cytology alone presents pictures of pathognomonic import.
3. Inaugurate concurrent typhoid disinfection.
4. Investigate those handling food for the detection of carriers.
5. Keep the convalescent under sanitary surveillance until free from the organism, disinfecting all stools.
6. Police the drinking fountains and heads, providing disinfectant for hands in the latter.
7. Acquaint personnel with the dangers and advised precautionary measures.

(B) During fleet concentration at Guantanamo Bay, where the harbor formation and tide and currents do not favor rapid change of water, and in other harbors already polluted or likely to become so quickly from the effluent of the ships:

1. A ship showing an unusual incidence of dysentery of the bacillary type should be kept away from the fleet anchorage until cleared of the disease or control established.

2. Swimming over the side and in any other part of the bay not free of pollution and the use of such harbor water for shower baths and the usual scrubbing purposes aboard ship should be allowed only with utmost watchfulness for the first indication of untoward results.

3. If cases of water-borne infection occur in anything suggestive of epidemic incidence and there is no other clearly evident source at which to place responsibility, the use of harbor water as above outlined should be strictly forbidden.

The two epidemics which have been experienced were fortunately mild in character. No deaths resulted, but there was a heavy loss of working strength and the fleet was embarrassed in carrying out its program. We have no right to expect that a repetition of these epidemics will be mild, or that there would be no deaths, or that the fleet program would not be seriously interfered with. At any time the specific organism may be the *Shiga bacillus* with a radical change of consequences for the worse. From every aspect the possibilities in another such epidemic are too serious to be lightly considered, and it should be prevented at the expense of considerable inconvenience, if necessary. It is infinitely preferable to have dirty decks for a few days than fouled decks and disease and crippled ships' companies and perhaps loss of life.

As long ago as the early seventies of the eighteenth century, Captain Cook, of the Royal Navy, after his successful experience in the prevention of scurvy by methods advised by Dr. James Lind, is reported to have said, "Precautions are always blamed; when they are successful, they are said to be unnecessary." Precautions can bear up under the gentle impeachment, as Captain Cook intended to imply, if they are faithfully observed.

CARBON MONOXIDE POISONING

Recognition of and interest in carbon monoxide as a cause of serious disability and death presents a history definitely extending back to the first century A. D., when Seneca employed the gas as a means to suicide, and probably to a much earlier date. It has been an increasing hazard to health and life with the multiplying complications of civilization. Many processes in modern industry produce it or are directly exposed to it, household conveniences are the source of it, and the ubiquitous automobile is constantly contributing it in generous quantity to the atmosphere, particularly of urban communities. In all of these, with a view to appraising the preventive problem, the questions involved are the concentration and period of exposure. The subtlety of its toxic influences and the dramatic suddenness of fatal poisoning by it inspire one's imagination with the prime importance of prevention.

Investigations, experiments, tests, and studies of it from the point of view of human exposure, susceptibility, and reaction (symptomatically and pathologically) have been made in varying degrees of thoroughness according to the light of successive decades and the implication of new experiences by a multitude of trained scientists from the earliest days. Every aspect of the subject from etiology to treatment has been painstakingly covered and the composite of our knowledge to date is finely, systematically, and exhaustively reviewed by R. R. Sayers, chief surgeon, United States Bureau of Mines, surgeon of the United States Public Health Service, and Sam J. Davenport, principal translator, United States Bureau of Mines, in Public Health Bulletin No. 195, published March, 1930.

As with society in general, so there is a growing concern with it in naval circles, not alone in directions common to the accidents and intent of warfare in the broad aspect shared by land forces, but in very special directions represented by ship construction. During the year 1929 there were two instances of CO poisoning involving a total of 12 men (3 of civilian force in one and 9 of service personnel in the other), and both occurred in a compartment of a battleship "blister." The feature of ships characterized by this term has come into being in the process of modernizing old ships.

It is a false hull strengthened by transverse and longitudinal frames which covers the original hull and conforms to the longitudinal lines of the ship. At the waist, the place of greatest beam, the top of the blister is practically flush with the sides of the ship, so that to enter its compartments on either side at this point one must pass through manholes in the casemates. Manholes in the horizontal frame provide for communication between the upper and lower compartments and the vertical frames are perfected by lightening holes. Except when in dock the manhole covers are kept tightly dogged in place to insure the water-tight integrity of these blister compartments, so that periods of months may elapse between opportunities to ventilate them.

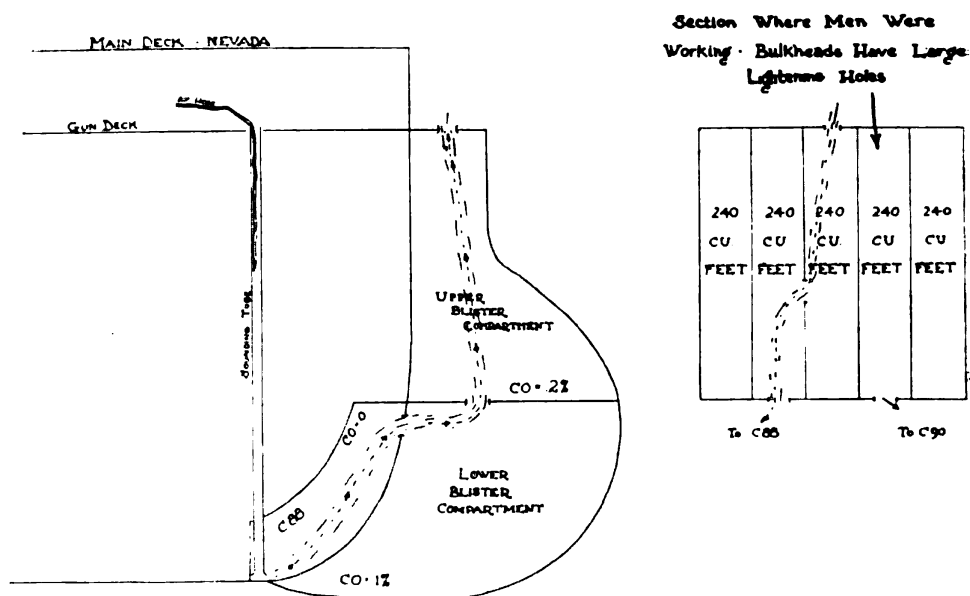
Extracts from the reports concerning the circumstances and cases on the U. S. S. *Nevada* and U. S. S. *New York* are here presented:

On February 12, 1929, a gang of three men, E. W., check No. 26-39, E. S. W., check No. 58-190, and J. A. C., check No. 58-321, were installing heating coils in oil tank C-88, a double-bottom compartment, in the U. S. S. *Nevada*. This same gang had been doing the same work in some 85 other tanks on the *Nevada*, work which had taken almost six months. To get into C-88 it was necessary to enter a blister compartment, go through to a lower blister compartment, and then into C-88. Because of the cramped working conditions in C-88, they were doing as much work as possible on the flat of the upper blister compartment. This compartment had a capacity of almost 1,200 cubic feet and was divided into five sections, each having a capacity of about 240 cubic feet.

Since bending of the coils was necessary, and E. W. had been using his oxygen-acetylene torch to heat the pipe, all three men were in one section of the blister compartment for almost $1\frac{1}{2}$ hours bending and welding these coils, with the exception of E. S. W., who was absent for about 10 minutes getting some measurements in C-88.

At 11.30 a. m., E. S. W. noticed that J. A. C. looked as though he was going to sleep and spoke to him; J. A. C. mumbled and then slumped over. The two W's then realized something was wrong and E. S. W. went up the ladder to get help. He said he felt all right until he got near the top of the ladder when he almost became unconscious. He reached the open air and managed to get through a port into the gun deck of the *Nevada*. E. W. dragged J. A. C. through a frame lightening hole to the next section of the compartment, the one directly

SKETCH OF BLISTER ON U.S.S. NEVADA WHERE MEN WERE OVERCOME BY CO ON FEB. 12, 1929.



below the manhole, to the open air, but then feeling his strength failing, went up the ladder himself. He states he had great trouble getting up to the open and had to be helped on deck by some other men. G. L. G., check No. 58-219, seeing the two men come out of the blister, evidently overcome by gas, and knowing there were three men working together, went down into the compartment and, with the help of another man and a line, got J. A. C. to the open air.

The ambulance was called and artificial respiration given. When the men arrived at the dispensary they were sent to the public health hospital and their cases diagnosed as carbon monoxide poisoning, which diagnosis was held by the hospital.

E. S. W. and J. A. C. returned to work to-day, February 19th, and E. W. will probably be back to-morrow.

Upon inspecting the blister compartment at about 3 p. m. on the 12th, I found the air clear and apparently pure. G. L. G. was with me and said when he went down after J. A. C. he noticed no smell of gas or smoke. A laboratory test of the air in the blister compartment was taken and showed 0.2 of 1 per cent

CO; C-88 showed no CO; the lower blister compartment showed 0.1 of 1 per cent CO. Another blister compartment, which had not been worked in, showed no CO. A compressed air hose was put in the sounding tubes to C-88 and each half opened so that fresh air was being blown into this tank and exhausting through the blister but was not directly ventilating the section of the blister where the men were working. (See sketch.)

According to several authorities the immediate products of combustion of an oxygen-acetylene torch are CO and H, but this is oxidized to CO₂ and H₂O in the air. Tests were carried out which proved that, with plenty of ventilation around the flame, no CO was given off, but that in a small tank unventilated, except through the top, small amounts of CO were generated. A cutting torch, even in a small tank, generated no CO because of the plentiful supply of oxygen.

It is believed that the cause of the poisoning of these three men was due to the CO given off by the torch when it was unable to get enough oxygen from the air to change all the products of combustion to CO₂ and H₂O. The section these three men were in had only 240 cubic feet of air in it, and the torch burning for 1½ hours and the men breathing for the same time, would use up the oxygen from about 280 cubic feet of air. Of course, there was fresh air coming in through the lightening holes in the frames, but no direct circulation of air. Therefore, as the oxygen content of the air was reduced the flame of the torch, although apparently unexpected, was not getting quite its required amount of oxygen and, therefore, giving off the CO which caused the poisoning.

On November 14, 1929, the U. S. S. *New York* was placed in dry dock at Portsmouth, Va., for the purpose of having the hull scraped and painted and other minor work done. Word was passed to have the blisters opened so they would be accessible for inspection by the navy yard force on the following day. The manhole covers were removed and the division officer having charge of the starboard midship blisters decided to descend into this particular compartment to see what condition it was in. He and three men entered the upper compartment and then started down the ladder to the lower compartment. Just as the officer, who was leading, entered the lower compartment he was seen to fall from the ladder clear to the bottom of the blister. The boatswain's mate thinking he had lost his balance and fallen, immediately, with two other men, entered the compartment and descended to the officer's assistance. When they reached the officer's side they too were overcome and others in the party realized that they were dealing with a vitiated atmosphere. A call was sent for rescue apparatus and air hose, but in the meantime two other men attempted to reach those in the compartment, and they too were overcome.

An air hose was then passed into the compartment, and a man with a smoke helmet and one with a navy rescue mask entered the blister. The smoke helmet was of no use and the rescue apparatus was so bulky that in passing through the manhole it was damaged. Finally a smaller type rescue apparatus was secured from the navy yard fire department. This apparatus consisted of a simple mask to which a long flexible hose was attached. The hose led to fresh air which was supplied to the mask by means of a hand-operated pump. With the aid of this apparatus and the fresh-air supply those least affected were helped from the compartment. The two cases that were fatally overcome were removed by passing lines around their bodies and hauling them out.

In all, nine men were affected by the atmosphere in the blister. Two of the cases terminated fatally, an officer and an enlisted man. The two fatal cases were dead when they were removed from the compartment, although artificial respiration and efforts to resuscitate them were continued for a period of two hours.

Of the cases which recovered, there were several degrees of intoxication evidenced, and this condition was by no means consistent with the length of exposure. As a matter of fact, one of the fatal cases was in a man who had entered the compartment some time after several of the other men had been in it.

On the whole the symptoms were the same. In the mild cases the faces were flushed and they exhibited various degrees of excitability, complaining of dizziness, weakness, and severe frontal headaches. The more severe cases were partly cyanosed, cold, and clammy, and exhibited symptoms of severe shock.

All cases were immediately put in a prone position, covered with blankets and hot-water bottles, and oxygen and carbon dioxide administered. Where respirations were feeble, Schaeffer's artificial respiration with the oxygen and carbon dioxide was given to stimulate the breathing. In the two fatal cases the pulmotor was used, but with no success.

The cases were all transferred to the naval hospital at Portsmouth, Va., where an examination of the blood from the two fatal cases showed poisoning by carbon monoxide. Twenty hours after death the blood was still in an unclotted state.

Owing to the fact that all hands were busily engaged in the work of resuscitation, no effort was made to obtain a sample of the air in the compartment for analysis. A diagnosis of carbon monoxide poisoning was made in the cases, owing to the similarity of symptoms to cases that have come under my observation while attached to submarines. As to the source of carbon monoxide I am unable to furnish any information. The compartments had not been opened for six months, they had been freshly painted about a year previously and when opened showed no marked growth on the side, although they were damp and slippery from sweat.

The generally accepted maximum concentration for comfortable tolerance is 4 parts per 10,000 of air, but this proportion can not be accepted blindly as an exact measure under all circumstances or as more than a guide to adequate protection. Other factors, such as age, length of exposure, temperature, humidity, susceptibility, and physical rest or activity, etc., enter into the determination of this, and reliable investigations show that symptoms of CO poisoning occur after prolonged exposure to as little as 4, 3, and even 2 parts of CO to 10,000 parts of air.

Human hemoglobin exhibits a relative preference for CO over oxygen in the proportion of about 250 to 1, the proportion varying according to different investigations, but this preference is seeming and not absolute as the rate and degree of combination of one or the other gas with hemoglobin depends upon the respective tension of the two gases in the mixture and is governed by the law of mass action according to the reversible reaction $\text{HbO}_2 + \text{CO} = \text{HbCO} + \text{O}_2$. This leads directly to the proposition of Nicloux that—

1. Pure CO displaces the oxygen in oxyhemoglobin.
2. Pure oxygen displaces the CO in CO hemoglobin.
3. When hemoglobin comes in contact with mixtures of CO and oxygen the hemoglobin is divided by the two gases, and the re-

spective proportions of the two hemoglobins, CO hemoglobin and oxygen hemoglobin, are according to the relative proportions or tension of the two gases in the gaseous mixture.

In other words, carbon monoxide hemoglobin is not a fixed chemical combination resulting in an irremediable anoxemia and it is this fact as formulated in the above propositions which gives fair promise, even in serious intoxication to the employment of proper therapeutic resources, specifically, that which seeks to displace the CO content and reestablish the respiratory function of the blood.

The nature and seriousness of the symptoms vary directly as the saturation and they have been classified in stage groups with each increase of 10 points above 10 per cent. Life is threatened at all the higher percentages, but in general a saturation of between 60 and 70 per cent and above is quickly fatal.

In the presence of life, even if the manifestation of lingering vitality is but a feeble cardiac systole, it is never too late, by artificial respiration or other means to respiratory activity, to displace the CO in the blood with oxygen and thus revive the patient, but it may prove impossible to reproduce the normal condition or ultimately preserve the revived life because of permanent damage to important tissues.

In treatment the all important therapeutic resource (oxygen) has been repeatedly mentioned in this review. Its proportion in mere fresh air is therapeutically effective. If pure oxygen is carried into the lungs in concentrated form by pressure the chemical change in the hemoglobin will proceed regardless of thoracic movement, but to realize its fullest prompt utilization the respiratory excursion must be increased first by the physical means of Schaeffer and then or concomitantly by central stimulation. A 5 per cent mixture of CO₂ in oxygen is alone approved for this purpose.

The chief factors in the prevention of CO poisoning are good ventilation, avoidance as much as possible of any exposure to air known to contain the gas, and the use of adequate protective equipment.

Breathing apparatus may be divided into two types as regards the length of time the apparatus will furnish pure air on one charging; these are the half-hour type, principally used on vessels or where men are only exposed to dangerous atmospheres for short periods of time, and the 2-hour type which is the kind used in mines.

Detecting devices and breathing masks should, of course, be available at times of possible exposure to CO, but, in addition, other precautions are suggested by the experiences above recounted, as follows:

1. That closed compartments be forcibly ventilated before they are entered.

2. That, in emergency need to enter closed compartments, masks and life lines be used with attendants stationed at the entrance.
 3. That no welding process, particularly by gas, be done in double bottoms or other similar closed compartment unless exhaust ventilation, preferably, or supply ventilation is provided by some efficient system to the compartment in which men are working.
 4. That pure compressed oxygen be conveniently available in case of need.
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AN OUTBREAK OF SCARLET FEVER ON BOARD THE U. S. S. "OKLAHOMA"

By W. L. IRVINE, Commander, Medical Corps, United States Navy

The outbreak consisted of seven cases. On the evening of December 31, 1929, a seaman, second class, reported at the sick bay for treatment because of a sore throat. He was admitted to the sick list and placed in isolation. The ship was at the navy yard, Philadelphia, Pa., at the time. Two days later symptoms of scarlet fever had developed and the patient was accordingly transferred to a hospital where the tentative diagnosis of scarlet fever was confirmed. This man had arrived on board 10 days before he was admitted, with a draft of men from the United States naval training station, Great Lakes, Ill. No case of scarlet fever among naval personnel was reported by that station during the months of November or December, 1929. The patient had been on liberty in Philadelphia, where the disease was quite prevalent, several times prior to the onset of symptoms. Statistical reports from this city indicate that 2,719 cases of scarlet fever were reported in 1929. Of these, 141 cases occurred during the period December 21 to December 31, 1929. Additional cases to the extent of 134 were notified from January 4 to January 10, 1930. Considering the incubation period as from two to seven days, it is probable that infection in this, the first case of the outbreak, was acquired in Philadelphia. The last case was admitted January 21, 1930.

Precautions were immediately taken to prevent spread of the disease. All close contacts were examined daily and those having tonsillitis or other symptoms suggestive of scarlet fever were isolated. At the same time measures were taken to insure efficient sterilization of the crew's mess gear and scuttle-butt drinking fountains.

The ship sailed for Hampton Roads, Va., on January 3, 1930. Following the appearance of the second case of the outbreak the next day while en route, the ship was placed in quarantine and the commander, Scouting Fleet, notified. The patient in this case was also a seaman, second class, and was from the same division as the first patient. Upon arrival at Hampton Roads the same day, he was transferred to a hospital and again the diagnosis was confirmed.

Daily inspection of the entire crew was now started and continued during the period of quarantine. All recognized cases of tonsillitis or sore throat which developed while the ship was at Hampton Roads were transferred to hospital, and all suspects were isolated in the ship's brig.

On the afternoon of January 8, 1930, the date of departure for Guantanamo Bay, Cuba, a patient under treatment for another disease in the sick bay during the preceding six days developed a rather severe tonsillitis and was at once placed in the isolation ward. The next day, upon the appearance of a characteristic rash, it was definitely decided that this was a case of scarlet fever. Daily inspection of the crew was continued. All those found to be suffering from sore throats or respiratory infections or who had a rash, no matter how trivial, were isolated and observed. It was soon apparent, however, that the brig was not a suitable place for the isolation of suspects, so on January 10, 1930, the crew's reception room, a large, airy compartment connected with a lavatory and toilet, was assigned to the Medical Department for use as a second isolation ward.

The fourth case was that of the junior medical officer, who became ill on January 12. When the ship arrived at Guantanamo Bay the following day the two patients, who were admitted while the ship was at sea, were transferred to the dispensary at the naval station. Three other cases appeared during the next 10 days, one on January 15, one on January 20, and the last case of the outbreak on January 21. These cases were also transferred to the dispensary ashore.

In the first two cases the diagnosis was confirmed at hospital and in the remaining five at the dispensary. None of the seven patients gave a history of scarlet fever, but the junior medical officer stated that before he entered the Navy he had been exposed several times without contracting the disease.

The data pertaining to the several cases may be summarized as follows:

TABLE I

Date of admission	Rank or rating	Age	Division	Place transferred	Disposition, duty	Number of sick days
Dec. 21, 1929	Sea-2.....	18	Sixth.....	Naval hospital, Philadelphia, Pa.	Feb. 7, 1930	38
Jan. 4, 1930	.....do.....	19	.....do.....	Naval hospital, Norfolk	Feb. 18, 1930	45
Jan. 8, 1930	Sea-1.....	22½	First.....	Dispensary, naval station, Guantanamo Bay.	Feb. 4, 1930	1 27
Jan. 12, 1930	Lieut. (J. g.)...	30	Medical Corps.	.....do.....	Jan. 24, 1930	12
Jan. 15, 1930	G. M.-3.....	22	First.....	.....do.....	Feb. 2, 1930	18
Jan. 20, 1930	Sea-1.....	23	R.....	.....do.....	Feb. 11, 1930	22
Jan. 21, 1930	F-1.....	38	B.....	.....do.....	Feb. 28, 1930	37

¹ Diagnosis changed to chancroid, concurrent disease.

The average age of the seven patients in the above table was 24.6 years. Sick days totaled 199. No other case of scarlet fever developed after January 21, and the ship was released from quarantine on January 28. During the epidemic there were 12 admissions for acute tonsillitis and 3 for pneumonia.

On January 22 the fleet surgeon obtained material sufficient for 500 Dick tests and directed that men in all of the following groups be tested: (a) All known contacts; (b) men at present on the sick list; (c) all men remaining aboard who were received from the two drafts from Great Lakes, Ill.; (d) all others who in the opinion of the medical officer should be tested.

Injections were started at 4 p. m. on January 22, and by 7 p. m. the test had been given to 497 individuals. Men who gave a history of having had the disease were not tested. Beginning at 2.30 p. m. the next day the results were read and 123 men were found to be positive to the test.

Material for 400 more Dick tests was obtained the following day and administered to 431 men, 117 of whom were subsequently found to give positive tests. Most of the officers and men who were under 35 years of age and who had not had scarlet fever were included in this group. Of a total of 928 men, Dick tested up to this time, 240, or 25.8 per cent, gave a positive reaction.

On the afternoon of January 24, or the day after the second group was tested, each of the 240 men who were found to be susceptible to scarlet fever by reason of a positive Dick test was passively immunized by injections of 1,500 units of scarlet fever antitoxin serum given intramuscularly in the buttocks. The serum was obtained from the naval station and from other naval vessels in the harbor. No anaphylactoid reactions were observed. Nearly all who were passively immunized complained of some malaise, and during the evening several developed fever. In no case, however, were reactions sufficiently severe to require admission to the sick list at this time.

Additional material for 200 Dick tests was obtained on January 27, and all remaining officers and men under 35 years of age, including those who gave a history of an attack of scarlet fever, were tested. Forty-two of 188 men gave positive reactions, and of these 26 were passively immunized. The remaining 16 were officers. Inasmuch as short-range battle practice was to start on the following day none of these officers was immunized.

The results of the Dick test are shown in the following table:

TABLE II

	Total	Over 35 years old	History of scarlet fever	Dick tested	Positive	Immun- ized	Per cent, positive Dick tests
Officers.....	66	22	22	145	16	0	35.6
Chief petty officers.....	35	21	7	14	0	0	0
Men.....	1,136	20	172	1,116	266	266	23.8
Total.....	1,237	63	201	1,175	282	266	24.0

¹ 1 officer over 35 years old requested the test. The result was positive.

It is interesting to note that of 40 Filipinos tested only one, 2.5 per cent, gave a positive reaction.

The first cases of serum sickness made their appearance at evening sick call on January 30, or six days after the administration of anti-toxin was started, and the last on February 7. Urticaria was the first manifestation of the disease. On subsequent days a few men developed scarlatiniform and measleslike rashes which would have been difficult to distinguish from scarlet fever and measles had it not been for a diffuse erythema at the site of injection, the absence of catarrhal symptoms such as coryza, sore throat, etc., and, finally, the appearance of characteristic articular pain and stiffness. These rashes disappeared rather quickly so that on subsequent days joint pains became the more prominent symptom. One man developed moderate edema of the vocal cords. All had a moderate degree of fever. Glandular enlargement was noted in several cases. In all, 40 patients, or 15 per cent, of those injected presented symptoms of serum sickness, and of that number 12 were admitted to the sick list. No doubt there were other mild cases. Those admitted to the sick list were incapacitated for an average of about five days. Treatment was symptomatic.

CONCLUSIONS

No definite conclusions can be drawn. Sporadic cases of scarlet fever appeared about every three to five days during the epidemic period. In only one instance were two cases, the first two, from the same division. It is generally recognized that the disease does not tend to spread under tropical conditions. Nevertheless, three cases of scarlet fever developed after the ship arrived at Guantanamo Bay. The last case of the outbreak occurred January 21, 1930. Three days later the first group of men who gave a positive Dick test were passively immunized. No other cases developed after passive immunization of susceptibles was started.

Editorial comment.—Scarlet fever in this outbreak seems to have been of a comparatively mild type. The report indicates that the administration of immunizing doses of scarlet fever antitoxin to most

of those who were positive to the Dick test was of value in controlling the outbreak. It should be borne in mind, however, that scarlet fever does not tend to spread in the Tropics. Furthermore, the disease does not tend to spread on board naval vessels if proper precautions are taken, which apparently was done in this instance. The probability that scarlet fever will not spread under existing conditions when introduced on board a naval vessel, as indicated in the annual report of the Surgeon General, United States Navy, 1929, was 22 to 1 in 1928, and 10 to 1 for the five years, 1924-1928.

Of those passively immunized, 240 received antitoxin three days after and 26 were injected six days after the last case appeared. Some of the 26 men in the latter group, however, were probably already immune by reason of a previous attack of scarlet fever. Therefore, it can hardly be assumed that the passive immunization of the 266 men who had previously shown positive Dick tests in itself caused the epidemic to stop. Preventive measures, such as prompt detection and isolation of new cases, effective concurrent disinfection, and sterilization of mess gear, as practiced on board the U. S. S. *Oklahoma*, would probably have had the same effect. In any outbreak one should not forget to consider what the result would have been had a certain measure not been employed.

Undoubtedly scarlet fever antitoxin was used because materials were not available for active immunization with toxin. Among the disadvantages of this procedure may be mentioned the pain and inconvenience caused by the injection, serum sickness, and short duration of the immunity conferred. Those who exhibited symptoms of serum sickness unquestionably will have more severe reactions should it again become necessary for any reason to inject serum. The use of antitoxin as a prophylactic agent is discouraged by practically all authorities because of the resultant severe reactions and because of reactions which may follow any subsequent injection of serum. If it should become necessary to establish artificial immunity in order to control an outbreak of scarlet fever in the Navy, the use of scarlet fever streptococcus toxin for the production of the active type is to be preferred.

HEALTH OF THE NAVY

The general admission rate, all causes, based on returns for April, May, and June, 1930, was 606 per 1,000 per annum, as compared with 323, the rate for the corresponding months of 1929. The median rate for the second quarter, as indicated by the records of the preceding five years, is 502.

The admission rate from disease was 542 per 1,000 per annum, as compared with 454, the 5-year median for the corresponding three

months. The admission rate from accidental injuries was 64. The median or expected rate for the corresponding quarter of the previous five years is 48.

Acute respiratory diseases, in general, were not more prevalent than is to be expected. A total of 1,342 cases of these diseases was reported by shore stations in the United States during the quarter, of which 545 were notified in April and 479 in May. As usual, catarrhal fever predominated. The United States naval training station, Newport, R. I., reported 139 cases; United States naval training station, Great Lakes, Ill., 171; and United States naval training station, San Diego, Calif., 292 cases, 140 of which were notified in May. The United States naval training station, Hampton Roads, Va., was remarkably free from the disease during the quarter, reporting only 26 cases. Mumps, which exceeded expectancy at the latter station during the period January, February, and March, continued prevalent during the second quarter of the year. The incidence of the disease, by months, January to June, inclusive, was as follows: 22, 10, 31, 45, 31, and 16.

Five cases of cerebrospinal fever, two of which terminated in death, were notified from shore stations in the United States, as follows: Naval training station, Newport, R. I., one case in June; naval training station, Hampton Roads, Va., one fatal case in April; and naval training station, San Diego, Calif., two cases in April (one fatal) and one case in May. The patients in both fatal cases were recruits. The case which occurred at Hampton Roads had been in the service three months. About a month after he was admitted to the hospital and was convalescing from cerebrospinal fever he developed lobar pneumonia and died a month later, or two months after his original admission. The other fatal case (naval training station, San Diego, Calif.) died four hours after he was admitted to the hospital. He had been in the service about three weeks.

The naval training station, Great Lakes, Ill., reported two cases of scarlet fever in April.

The outbreak of diphtheria, which began in February at the naval training station, Newport, R. I., continued through the second quarter of the year. The incidence of the disease was about the same, 23 cases being notified this quarter, as compared with 21 reported during the period January to March, inclusive.

The admission rate, all causes, for forces afloat was 553 per 1,000 per annum. The median for the second quarter of the preceding five years is 423. There were 975 cases of catarrhal fever notified from all ships for the quarter. This disease exceeded expectancy for ships attached to the Battle Fleet, which fleet was responsible for 46 per cent of all the cases reported. Only 22 cases of influenza were notified during the quarter. Eight cases of scarlet fever were reported—

U. S. S. *Whitney*, four, and U. S. S. *Chase*, one, in April; U. S. S. *Arkansas* and U. S. S. *Herbert*, one, in May; and U. S. S. *Saratoga*, one, in June. Two fatal cases of cerebrospinal fever were notified, one in May from the U. S. S. *John D. Ford*, in Chinese waters, and one in June from the U. S. S. *Asheville*, in Central American waters.

Bacillary dysentery appeared in epidemic proportions during the fleet concentration period in the Guantanamo area. The first cases appeared in March and extended into May, making a total of 533 cases reported by all ships that participated in the outbreak. A detailed account of the epidemic appears in this issue of the **BULLETIN**.

TABLE NO. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended June 30, 1930

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	75,390	41,199	19,398	116,589
All causes:				
Number of admissions.....	10,418	7,250	2,948	17,668
Annual rate per 1,000.....	552.75	703.90	607.90	606.16
Disease only:				
Number of admissions.....	9,421	6,378	2,575	15,799
Annual rate per 1,000.....	499.84	619.24	530.98	542.04
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	2,515	2,577	763	5,092
Annual rate per 1,000.....	133.44	250.20	157.34	174.70
Venereal disease:				
Number of admissions.....	3,552	983	703	4,535
Annual rate per 1,000.....	188.46	95.44	144.96	155.59
Injuries:				
Number of admissions.....	989	864	369	1,853
Annual rate per 1,000.....	52.47	83.89	76.09	63.57
Poisoning:				
Number of admissions.....	8	8	4	16
Annual rate per 1,000.....	.42	.78	.82	.55

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended June 30, 1930

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,673	1,792	86,230	1,194	18,198	502	116,589
CAUSE: DISEASE								
Primary	Secondary or contributory							
Abscess, liver.....	Pneumonia, broncho.....					1		1
Alcoholism, acute.....	None.....			1				1
Do.....	Dilatation, cardiac, acute.....			1				1
Appendicitis, acute.....	Peritonitis, general, acute.....			2				2
Do.....	Abscess, brain.....			1				1
Arteriosclerosis, general.....	Angina, pectoris.....	1						1
Do.....	Myocarditis, chronic.....			1				1
Caisson disease.....	Persistent thymus gland.....			1				1
Carcinoma, pancreas.....	Nephritis, acute.....						1	1
Carcinoma, oesophagus.....	Metastasis, liver.....					1		1
Do.....	Pneumonia, broncho.....			1				1
Cerebrospinal fever.....	None.....			3				3
Do.....	Pneumonia, lobar.....			1				1
Calculus, kidney.....	Nephritis, acute.....	1						1
Cystoma, liver and kidney.....	Hemorrhage, cerebral.....			1				1
Diphtheria.....	Myocarditis, acute.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Influenza.....	do.....			1				1
Do.....	Pneumonia, lobar.....			1				1
Do.....	Septicemia.....			1				1

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended June 30, 1930—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	Men		
Average strength.....		8, 673	1, 792	86, 230	1, 194	18, 198	502	116, 589
CAUSE: DISEASE								
Primary	Secondary or contributory							
Measles.....	Pneumonia, broncho.....			1				1
Myocarditis, chronic.....	Angina, pectoris.....	1						1
Nephritis, acute.....	Pneumonia, lobar.....			1				1
Nephritis, chronic.....	Pneumonia, broncho.....			1				1
Otitis, media, acute.....	Meningitis, cerebral.....			1				1
Pneumonia, lobar.....	None.....			2				2
Do.....	Syphilis.....			1				1
Sarcoma, neck.....	Pneumonia, broncho.....			1				1
Syphilis.....	Myocarditis, chronic and pneumonia, broncho.....					1		1
Tonsillitis, acute.....	Myocarditis, acute.....			1				1
Tuberculosis, pulmonary, chronic.....	None.....			4		2		6
Do.....	Myocarditis, acute.....			1				1
Do.....	Tuberculosis, intestines and larynx.....			1				1
Do.....	Hemorrhage, lung.....			1				1
Ulcer, duodenum.....	Cardiac arrhythmia, auricular fibrillation.....			1				1
Ulcer, stomach.....	Hemorrhage, stomach.....			1				1
Total for diseases.....		3		36		5	1	45
CAUSE: INJURIES AND POISONING								
Primary	Secondary or contributory							
Drowning.....	None.....	1		5		2		8
Landplane crash: Drowning.....	do.....					1		1
Electric shock, injuries from.....	do.....			1				1
Fracture, compound, skull.....	Hemorrhage, subdural.....			1				1
Do.....	Pneumonia, lobar.....			1				1
Fracture, simple skull.....	None.....					2		2
Do.....	Intracranial injury.....			2		1		3
Fracture, femur, tibia and fibula.....	Hemorrhage, femoral artery.....			1				1
Intracranial injury.....	Hemorrhage, middle cranial fossa.....			1				1
Injuries multiple extreme.....	None.....			4				4
Landplane crash: Intracranial injury.....	do.....				1			1
Rupture, traumatic, jejunum.....	do.....			1				1
Rupture, traumatic, spleen.....	Hemorrhage, intro-abdominal.....					1		1
Wound, gunshot, forehead.....	None.....				1			1
Wound, gunshot, abdomen and forehead.....	do.....					1		1
Wound, incised, thigh.....	Hemorrhage, femoral artery.....			1				1
Wound, incised, chest.....	None.....					1		1
Wound, penetrating, brain.....	do.....	1						1
Poisoning, phenol derivative, acute.....	do.....			1				1
Total for injuries and poisoning.....		2		19	2	9		32
Grand total.....		5		55	2	14	1	77
Annual death rate per 1,000:								
All causes.....		2.31		2.55	6.70	3.08	7.97	2.64
Disease only.....		1.38		1.67		1.10	7.97	1.54
Drowning.....		.46		.23		.44		.27
Injuries.....		.46		.60	6.70	1.54		.79
Poisoning.....				.05				.03

ADMISSIONS FOR INJURIES AND POISONING, SECOND QUARTER, 1930

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the second quarter, 1930, is based upon all Form F cards covering admissions in those months which have reached the bureau.

	Admissions, April, May, and June, 1930	Admission rate per 100,000 per annum	Admission rate per 100,000, year 1929
INJURIES			
Connected with work or drill.....	764	2,621	2,738
Occurring within command but not associated with work.....	625	2,144	1,818
Incurred on leave or liberty or while absent without leave.....	464	1,592	1,354
All injuries.....	1,853	6,357	5,910
Industrial poisoning			
Occurring within command but not connected with work.....	4	14	34
Associated with leave, liberty, or absence without leave.....	5	17	157
Poisoning, all forms.....	16	55	228
Total injuries and poisoning.....	1,869	6,412	6,138

Percentage relationships

	Occurring within command				Occurring outside command	
	Connected with the performance or work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or A. W. O. L.	
	April, May, and June, 1930	Year, 1929	April, May, and June, 1930	Year, 1929	April, May, and June, 1930	Year, 1929
Per cent of all injuries.....	41.2	46.3	33.7	30.8	25.1	22.9
Per cent of poisonings.....	25.0	14.9	31.3	68.7	43.7	16.4
Per cent of total admissions, injury, and poisoning titles.....	41.1	45.1	33.7	32.2	25.2	22.7

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from April, May, and June, 1930, reports, are worthy of notice from the standpoint of accident prevention:

Hatchway hazards—improperly guarded open hatches.—Several accidents have been reported from various ships in which enlisted men have fallen through open hatches which were improperly guarded. The total loss of time was 36 days, and all cases were reported as due to the "negligence of other persons."

Hatch-cover hazard—unsecured hatch cover.—While going down a ladder a fireman, third class, slipped. In falling he grabbed the knife edge of the hatch combing and the hatch cover fell on his left hand, inflicting a lacerated wound of the second and third fingers. He was on the sick list five days. The case was reported as "equipment at fault" in that the hatch cover could not be secured.

A seaman, second class, failed to secure properly the hatch cover before descending a hatch. He suffered a compound fracture of the left humerus when the hatch cover fell on his arm. Fifty-seven days were spent on the sick list, of which 49 were in a naval hospital. The case was reported as due to "man's negligence."

Dangerous practice—power-driven machine hazards (negligence).—Due to own negligence, an officers' steward, third class, suffered a lacerated wound of the left middle finger when he attempted to remove the "worm" of the meat grinder with his hand while the motor was running. Loss of time, nine days.

A private marine sustained a lacerated wound of the tip of the middle finger when he tried to force the meat through a meat grinder while in operation. The case was reported as "due to man's own negligence," as he failed to use the paddle provided for that purpose. Loss of time, four days.

In attempting to force meat through a meat grinder in operation an apprentice seaman received a lacerated wound of the right index finger. The accident was "due to his own negligence," since he did not use the paddle provided for the purpose. Loss of time, seven days.

While a seaman, second class, was operating a joiner his attention was diverted from his work, and, in looking up, his right hand slipped over the blades of the joiner, resulting in a lacerated wound of the thumb. No loss of time. The case was reported as "due to man's own negligence," because he did not shut off the power before he looked away from the machine.

Dangerous practice—Gasoline hazards (negligence).—Due to the negligence of another person in failing to prevent gasoline from going over the side of the ship's boat in fueling, a seaman, second class, was burned about the head, neck, and arms when the gasoline on the surface of the water ignited through some unknown cause. Loss of time, 85 days.

Lack of safety device—Power-driven machine hazards.—On account of lack of a safety device, a carpenter's mate, third class, received a simple fracture of the mandible when he was struck by a block of wood thrown by a power circular saw while it was being operated by another man. Loss of time, 48 days in a naval hospital.

A fireman, second class, while on duty as engineer of a motor boat, had the leg of his trousers caught in an unprotected clutch of the motor, resulting in a lacerated wound of the right foot. Loss of time, 46 days. The case was reported as due to "lack of safety device where one could be used."

A private marine sustained a lacerated wound of the second, third, fourth, and fifth fingers of the left hand while operating a power saw without a guard. Loss of time, 32 days.

Lack of eye protection—Flying particles.—A flying particle lodged in the right eye of an engineman, second class, while he was chipping paint with a pneumatic chipper without wearing protective goggles. Loss of time, one day. The case was reported as due to "man's own negligence."

Unsafe practice—Swabbing deck of wash room with hydrochloric acid.—While a chief machinist's mate was washing his face in the wash room he dropped his towel on the deck, which had been recently swabbed with hydrochloric acid. In drying his face with this towel he received chemical burns of both eyes. Loss of time, 10 days.

Faulty water gauge.—Due to "faulty material," a water gauge on a boiler broke. The flying particles of glass struck a water tender, inflicting a lacerated wound of the right forearm. No loss of time.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations.

Cumulative data

	Number	Per cent of recruits received	Per cent of recruits reviewed
<i>Jan. 1 to Dec. 31, 1929</i>			
All naval training stations:			
Recruits received during the period.....	13,531		
Recruits appearing before board of medical survey.....	709	5.24	
Recruits recommended for discharge from the service.....	323	2.39	45.56
<i>April, May, and June, 1930</i>			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	441		
Recruits appearing before board of medical survey.....	12	2.72	
Recruits recommended for discharge from the service.....	5	1.13	41.67
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	505		
Recruits appearing before board of medical survey.....	41	8.12	
Recruits recommended for discharge from the service.....	38	6.52	92.68
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	627		
Recruits appearing before board of medical survey.....	10	1.59	
Recruits recommended for discharge from the service.....	10	1.59	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	384		
Recruits appearing before board of medical survey.....	89	23.18	
Recruits recommended for discharge from the service.....	10	2.60	11.24

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations:

Dental defects.—Enlisted at Nashville, Tenn., July 17, 1930. Teeth Nos. 1, 3, 7, 13, 16, and 32 were either missing or impacted, and Nos. 4, 8, 14, 15, 18, 19, 29, 30, and 31 were carious. Tooth No. 14 was nonvital. There was apparent pulp involvement in No. 15.

All teeth were generally unsound and the indicated exodontia would produce large edentulous spaces necessitating prosthetic appliances. Surveyed July 21, 1930.

Sinus involvement.—Enlisted at Indianapolis, Ind., July 10, 1930. Examination revealed multiple involvement of the paranasal sinuses, including both antrums and the left frontal. The right frontal sinus was unicellular and small. There was a history of repeated attacks of sinusitis and operative treatment prior to enlistment. Surveyed July 16, 1930.

Visual defects.—Enlisted at Raleigh, N. C., July 7, 1930. History of frequent headache and of eye trouble all his life. Until three years ago he had worn glasses constantly. Vision in both eyes was only 20/200, due to a high myopic astigmatism. Surveyed July 16, 1930.

Deformity.—Enlisted at Louisville, Ky., June 18, 1930. There was a 3-inch scar of the scalp with marked underlying bony depression. In addition, the arches were depressed and there was a marked overriding of the little toe of each foot. Surveyed July 2, 1930.

Enlisted at Melrose, Mass., July 15, 1930. An old fracture of right ulna about 1 inch below but extending into joint, resulting in considerable angulation at the point of fracture with some shortening and atrophy. Surveyed July 24, 1930.

Glandular involvement.—Enlisted at Pittsburgh, Pa., July 1, 1930. Definite enlargement of thyroid gland associated with tachycardia and tremor of the fingers. He had been under treatment for the condition for the past two years. Surveyed July 7, 1930.

Constitutional inferiority.—Enlisted July 17, 1930. Examination of this recruit revealed a slender physique, with poorly developed musculature and bad posture. Mentally he was dull and of less than sixth-grade grammar-school development. Power of concentration was very poor, and he was unable to perform the simplest drill or duty without repeated instruction. Surveyed July 24, 1930.

Enlisted at Chicago, Ill., July 1, 1930. Physique poor and undeveloped, with adenotic expression (a mouth breather), marked malocclusion of teeth, and depressed arches. His intelligence was below that of the grammar-school sixth grade, at which stage his education ended, and he gave a short history of a varied and itinerant career in the way of occupation. He did not know his own age, but appeared to be 15 years old. Surveyed July 2, 1930.

Venereal disease.—Enlisted at Louisville, Ky., July 18, 1930. He had a gonococcus infection of the urethra. There was a profuse discharge which was positive for both intra and extracellular gramnegative diplococci. Surveyed July 23, 1930.





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THE MEDICAL DEPARTMENT OF THE NAVY



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IN CHARGE



Edited by
LIEUTENANT COMMANDER ROBERT P. PARSONS
MEDICAL CORPS, U. S. NAVY



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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to the exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes, and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

Surgeon General United States Navy.

NOTICE TO SERVICE CONTRIBUTORS

Contributions to the **BULLETIN** should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The **BULLETIN** intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

U. S. NAVAL MEDICAL BULLETIN

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No. 2

SPECIAL ARTICLES

A PSYCHOLOGICAL STUDY MADE ON CANDIDATES FOR AVIATION TRAINING

By C. G. DE FONEY, Lieutenant, Medical Corps, United States Navy

For a period of nearly two years a study was made of the officers and men reporting at the naval air station, Pensacola, Fla., for aviation training, with the view of determining those psychological factors which made for or against the individual's ability to qualify as a naval aviator or pilot.

This study, originated by Capt. D. G. Sutton, Medical Corps, United States Navy, and carried to its conclusion by the writer, was made on 628 individuals, and has resulted in the accumulation of certain data which has been classified, tabulated, analyzed, and made the subject of a report, which has been submitted to the Bureau of Medicine and Surgery. This article contains the essence of that report.

During recent years those medical officers and other authorities having an intimate knowledge of aviation and its requirements have expressed themselves as being of the opinion that psychological factors have an important bearing on an individual's ability to qualify as a military aviator. Some have expressed the opinion that psychogenic factors are of more importance than certain physical requirements that are now included in aviation physical examinations. Harboring this belief, a psychological examination of all candidates for aviation training has been carried on in the Army since the war, and in the Navy since 1921.

This examination was in many cases, at least in the Navy, made in a perfunctory manner, and in all cases the method of arriving at the final estimate was not a standardized one. While an opinion was expressed as to the candidate's value to aviation, the means to the end were not recorded. In addition, no means of measuring the various factors was determined upon, so that in the end the expressed psychological rating was merely a general estimate.

With a view of making an approach to the solution of the problem, the Bureau of Medicine and Surgery in September, 1928, directed

that the situation be studied in Pensacola and a method of psychological investigation be instituted for the purpose of collecting data along these lines.

From association with aviators and pilots, it was possible to determine the good and bad types and also those psychological traits which appeared to have a bearing on their success or failure to measure up to the standard demanded by the service.

This classification of types has always been made by the aviators themselves, in so far as ability to accomplish certain types of flying is concerned. Some are considered good combat flyers by all their associates, others only fitted for observation or bombing, and some just good seaplane pilots. These limitations are recognized by the pilots themselves, and it is appreciated by them that some factor in their personality make-up is responsible for their inability to accomplish the ultimate goal of combat flying.

Association with both the good and bad types soon led to determination of some of those personality qualifications that appeared to have a bearing on success or relative failure.

Having come to some conclusion as to the relatively good type, after association and study of all types of aviators and all classes of student aviators under stress of training, the examiners soon formulated the theory that instability of any kind was indicative of a poor type.

Sutton (1) says:

Unstable individuals appeared to have great difficulty in adjusting themselves to aviation. The self-conscious, sensitive, introspective individual with frank neurotic tendencies and the unstable extrovert with his unmistakable compensatory reaction of well-being appeared to have difficulty in adjustment that reacted adversely in the attempt being made to qualify; frequently personality difficulties would be evidenced by impaired judgment or interest, a lack of normal force and initiative, and not infrequently by subnormal attention. Deviations from the normal in the elements referred to were not infrequently recognizable on the surface after a relatively short contact between the individual and the medical observer, but since reliable information was mandatory and desired, it was determined that only a carefully conducted detailed psychological examination would meet the requirements. It was desired that such an examination would eventuate in the development of facts in relation to the individual being examined rather than the accumulation of impressions which could not be substantiated by reference to certain well-known psychological interpretations. In other words, the authorities were desirous of dealing with psychological conclusions relative to character traits that could be accurately measured and applied generally and not with those factors having a hypothetical rather than a well-recognized basis.

The psychological examination form, therefore, was molded to a large degree to bring out indications of instability in candidates for training.

Uncompensated neurotic tendencies, indications of emotional instability, suggestions indicative of a "shut in" trend, evidently poor concentration, undeveloped memory or intellect, and other suggestive psychological factors were carefully investigated to determine their true value. Where psychological findings were believed to be invaliding or indicative of personality problems unsuccessfully handled by the individual, a more detailed study was attempted prior to forming an opinion. In other words, the detection of the neurotic type of individual was considered to be the most important function of the psychological examination. In no case, however, were questions asked that proved to be objectionable in any way, and in most instances the reaction time in response to the question was of greater value than the reply itself.

The examination form included the usual questionnaire referable to family and personal history of the individual candidate; a personality study patterned after that of Amsden; certain tests for the determination of concentration, attention, etc., and finally a test for reaction time, which eventuated in a valuable means of typing individuals on a psychological basis.

No detailed discussion of either the examination form or the method of making interpretations will be indulged in at this time, except to state that an endeavor was made to uncover the individual's inner self, to determine his mental make-up or organization with special reference to his habits of thought and action, particularly when confronted by strange and difficult situations.

At a later date, if the plan presented appears to warrant its continuation here or its use at the places where the original application is made, the details of the examination itself can be reported on at greater length.

The problem was to estimate the amount of instability which an individual might have and still be considered good or fair material by reason of other traits which might compensate for his partial lack of control. In some cases that were considered border-line material it was felt that relative instability was well compensated for by normal courage and aggressiveness.

In other cases, usually those of the manic type, aggressiveness was recognized as a compensatory reaction. Measuring the individual's automatic reactions to the various situations arising during his lifetime as compared to normal responses was another problem which, with others encountered from time to time, had a definite bearing on the final construction of the psychological examination form determined upon.

In the beginning of this study it was thought advisable to attempt to measure by a given grade each trait or character component, so that when a final analysis was made it would be possible to sum up

the various traits in those that were successful and in those that failed and in that manner arrive at a conclusion as to which of these traits seemed to make for or against success. Grading on a numerical basis was decided upon for the other important reason that during the flight-training course a student is given standard markings on his ability to perform various tasks or maneuvers in ground school or in flying. It was thought that a parallel might be noted between the psychological rating and his practical mark for the training course. This similarity was noted and was particularly striking in many cases, especially in those marks given students by instructors in adaptability, stability, manner in emergencies, judgment, and reaction time. For uniformity the Navy system of marking was used, a mark of 4 to denote the best type and 0 the poorest.

In a too great endeavor to parallel the marks given in the training courses, the highest mark given in a psychological rating was 3.5. Had the higher figure of 4 been used for the best types, a more striking difference would have been noted in the average figures assigned those completing the course and those failing.

The measure of ability to succeed was determined upon by a certain standard of requirement which was then set forth by the syllabus of flight training then in vogue. This allowed the student 10 hours of dual instruction in primary seaplanes before he was given a check or a trial flight to determine his fitness to solo or fly alone; a compulsory course in combat planes was included as well as the usual land-plane course. Upon failing in two or three check flights the student was usually dropped from the course as inapt, and rarely was he given extra instruction before this decision was made. Sometime after this study had been inaugurated and a psychological standard established, a new syllabus of flight training was introduced which superseded the previous one. The requirements were made much easier for the student by this change in the method of instruction. He was now given 15 hours dual instruction in primary seaplanes before being given a trial or check flight. If he happened to fail two of these check flights he was given two or three hours extra instruction by the flight board of the squadron to which he was attached. If he again failed on his rechecks, he was then sent to the advisory board, where he was often granted three hours of extra instruction. When his case was reviewed by the commandant, he was at times given more instruction. This procedure of granting so much additional instruction under the new syllabus very naturally resulted in the qualification of a large number of students who under the old syllabus very probably would have failed. Since psychological estimates were made on the basis of the requirements by the old syllabus, the introduction of the new syllabus very naturally influenced the percentage of error in the selection of material.

No change in the psychological standard was made, however, since it was realized that such a step would mean delay and the loss of the large volume of work already completed. In addition to the original psychological findings, the progress of each student during his course of training was followed by the medical officers attached to the various training squadrons. Records were kept of his progress, of any extra instruction given, the remarks of the instructors noted, and finally the squadron medical officer's opinion of the individual with such comment as was pertinent to the case. These opinions were checked against those formed at the original psychological examination, and this helped to establish in the psychologist's mind the value of the various traits noted by him during the continuance of the personality study on the 628 students. The various character components were noted and evaluated in relation to aviation adaptability. Those listed below were thought to have the greatest bearing upon the individual's acceptability for aviation training.

These grades represent the average figures for those who qualified as naval aviators or pilots and those who failed to qualify.

The averages arrived at were obtained by adding the individual figures in each character component and dividing the total by the number of individuals involved. The numerical evaluations expressed were estimated at the time that the various students reported for training.

Those qualifying:		Those failing:	
Courage.....	3.2	Courage.....	2.8
Stability.....	3.1	Stability.....	2.3
Aggression.....	2.8	Aggression.....	2.3
Concentration.....	3.4	Concentration.....	3.4
Intelligence.....	3.6	Intelligence.....	3.4
Reaction time.....	1.35	Reaction time.....	1.41

It will be noted in the above table that the elements of courage, stability, and aggression stand out. The average marks of those passing or qualifying are noted to be definitely higher, in the three components mentioned, than the corresponding marks of those that failed. This is especially true of the element of stability, which the examiners at the beginning of the study believed to be of paramount importance. It is believed that the findings as shown in the above figures on stability justify this supposition, and also make it apparent that this factor, in its varying degrees, can be recognized and evaluated by an examiner experienced in the work. The figures as shown, it must be remembered, are those values placed on the various components at the time of the original psychological examination. In the cases of those qualifying, the examination had been made eight months prior to the time when it was definitely known whether the student would pass or fail. Concentration and intelligence, it can be seen, apparently had very little bearing on

success or failure, but it must be admitted that both these factors are desirable in a military aviator who is expected to cooperate with and advise the ground forces in time of action. This apparent lack of influence on the ability to pass the course was anticipated, in so far as intelligence is concerned, since the students were, for the most part, selected material of the same general average intelligence. The highly intellectual individuals, the bookworms, and grinds who had previously reported for training at Pensacola had not done so well as a group; a very low percentage of this type complete the course. This is easily explained, since this type of individual is usually the poorly rounded out personality, the poor mixer, the introspective, overly serious, sensitive individual who enlarges on the possibilities of danger and failure. This type fares poorly under the present system of trial flights at frequent intervals with a check pilot. It has also been noted that the mentally dull, self-satisfied, extraverted individual does much better here for the opposite reasons that he is either too dull to know when he is in trouble in the air, would not admit it if told that he was, and is not thinking of the future or possibilities; he lives only in the present moment and hence is relieved of the mental load that the previous type mentioned carries. This second type, however, being indifferent to dangerous situations and possibilities, is the careless flyer who is always having real or near collisions in the air, beach crashes, grandstanding for the crowd's applause, and causing much repair work on previously good airplanes. With aviation, as with other occupations, men become indifferent to dangers by constant association with situations that are hazardous, so that the man who is alert and appreciates the danger is always a more desirable aviator.

An indication of the individual's reaction time was obtained by application of the domino test. This test was originated by Doctor Rippon, of the Royal Air Force. It was first thought that actual reaction time might be of assistance in selecting personnel, but after several hundred tests had been made, it was realized that the time alone was of little practical value. As shown by the above figures, there is merely an average difference of 0.6 second between those qualifying and those failing, the difference being in favor of those who passed. A careful analysis of all reaction time figures as shown by this test has failed to reveal anything that might be of practical value in the selection of aviation personnel. On the other hand the test has demonstrated itself to be of value because of the opportunity it presents to check up on psychological data developed in the body of the general examination. The personality study as conducted frequently suggests the existence of such factors as overcautiousness, indecision, impaired judgment, impulsiveness, and excitability under pressure, and the domino test affords us an opportunity to rapidly check and evaluate such characteristics.

The test also demonstrates coordination, intelligence, judgment, attention, and the individual's usual attitude in approaching new problems. The examiners therefore feel that this test is of definite value.

All psychological examinations were treated as confidential matter. No information was divulged to anyone who might be directly interested in the opinion held by the examiners. However, when the student failed to meet the training requirements on any test or check flight, and when the student appeared before the advisory board by reason of this fact, the psychological data were made available for the authorities. This latter procedure was made mandatory by the new syllabus which went into effect in November, 1929. Here was noted the close resemblance between the opinions formed by the psychologists after the examination and those gained by instructors during actual flights. As a result of these contacts, the authorities in charge of aviation instruction at Pensacola have expressed themselves as being convinced of the utility of the procedure.

The following charts constitute the expression of psychological opinions compared with the actual results obtained during the training of the 628 individuals who were considered in this study.

Figure I represents a group of 212 officers and men selected by psychological examination as being good aviation material. Since the element of error in this group was only 30 per cent, it is evident that satisfactory results were obtained. This especially in view of the fact that the standard of training was materially altered by the introduction of a new syllabus during the progress of the study.

Figure II represents a group of 416 officers and men selected by psychological examination, from a total of 628 individuals, as being poor aviation material. Two hundred and eighty-one or 68 per cent of these actually failed as predicted, but 135 qualified. This latter figure is important to bear in mind, since the two charts that follow are graphic pictures of just what happened to these same 135 individuals who qualified as fliers, even though the psychologists thought that they were poor material.

Figure III is an outcome of Figure II. It shows that of the 135 officers and men who were judged by psychological examination to be poor aviation material, but who qualified as aviators or pilots, 64, or 47 per cent, of these required extra hours of instruction in order to complete the course of training. This fact reduces the manifest error of 30 per cent as shown in Figure II to an actual error of 17 per cent, since the psychological predictions were based upon a syllabus that allowed no extra instruction time, and it is presumed that these 64 individuals therefore would have been dropped from aviation training upon failing to satisfactorily pass the various check or trial flights.

Figure IV is a development of Figure III and shows the great number of crashes in this same group of 135 officers and men who were considered poor aviation material by psychological examination. Their rate of crashes is twice that of all the pilots in the Navy during the fiscal year 1928-29 and more than twice that of 135 pilots who were considered good aviation material from the group of 628 men studied psychologically. It will be noted that the rate of crashes shown on all pilots in the Navy during the year referred to above shows a rate approximately midway between that of the group considered good material and that considered poor by psychological examination. This was to be expected, since this group contained a mixture of both good and bad material.

The unusually high crash rate in this group of 135 officers and men, who were estimated by psychological examination to be poor material, seems to justify that opinion, even though these individuals qualified as aviators at Pensacola.

Figure V shows a group of 59 officers who were considered by psychological examination as being poor aviation material. Forty-eight of these, or 82 per cent, failed to qualify for combat flying. Since it is understood that this type of flying is most useful in actual warfare, and at Pensacola an effort is made to qualify all officers in this type of flying, it is evident that this group did not measure up to the standard expected. This is in accord with the psychological estimate made before they began training.

When the report was made, three of the officers in this group had been lost to aviation, two by reason of death in crashes, and one having been considered inapt and unqualified for flying when he reported to an operating squadron. Since then three more of this group have been killed and two others have had serious crashes, resulting in one case in the man's probable loss to aviation, as his injuries were very extensive.

Figure VI shows a group of 53 officers and men selected by psychological examination as being poor aviation material and given a final grade of 2.3 or below, but who qualified nevertheless as naval aviators or pilots. Thirty-five of these, or 66 per cent, required extra instruction in order to qualify. Such a large number requiring extra instruction, appears to confirm the original psychological opinion expressed.

Figure VII shows the psychological estimates and grades given on all individuals reporting at Pensacola for flight training during the continuance of the study made on the 628 individuals.

All those individuals predicted to qualify were marked 2.5 or above and all those predicted to fail were marked 2.4 or below.

It will be noted that the graph shows both the predictions and the actual results obtained in training. While psychological estimates were made in every individual case, actually, no one was eliminated by recommendations based on these estimates. The study was made to establish a basis upon which recommendations might be made in the future. The graph demonstrates the fact that the psychological estimates were 70 per cent correct throughout. This estimate is increased to 83 per cent correct by the elimination of those classed as poor material in this analysis but who required extra instruction in order to complete the course at Pensacola. On the negative side of the graph it is seen that those predicted to fail far outnumber those who succeeded. In other words, both the predictions of success and failure demonstrate the utility of the psychological method of selection.

It will be further seen that among those selected as being very good material by this method, none failed to qualify, and among those selected as being very poor material, but two qualified. The graph also shows the large border-line group graded from 2.6 to 2.4, in which the number of psychological errors with regard to success or failure is most numerous. While the percentage of errors in this group was 51, that figure fortifies the original opinion held by the examiners that elimination by psychological examination should not be attempted in border-line cases, at least not until the method has reached a greater degree of perfection.

Figure VIII is a comparative graph. It shows the actual results obtained by the flight training of 628 individuals sent to Pensacola for that purpose, and the probable results had the 628 men been selected by psychological examination. This hypothetical assumption is thought to be a just one, since both graphs and the percentages obtained are based on the same group of individuals.

Table I shows all individuals who were included in this study by rank or rating. The number in each class and the percentage of success in training is shown.

The examiners noted that electricians' mates, radiomen, and pharmacist mates were the least successful in the order named. Several ratings, however, were less successful, but the number actually taking training in these groups was so small that percentage figures based on the results would be of no value.

There follows a list of all individuals, by rank and rate, who reported to Pensacola for flight training during the psychological

study. The number in each class and the percentage of success in each is shown:

Rank or rate	Number reported	Percentage qualifying	Rank or rate	Number reported	Percentage qualifying
Officers, Navy.....	166	54	Seamen.....	74	19
Officers, Marine Corps.....	34	50	Yeomen.....	11	18
Reserve students.....	98	84	Radiomen.....	12	16
Marines, enlisted.....	21	52	Electrician's mates.....	15	13
Storekeepers, Navy.....	4	50	Firemen.....	11	.09
Fire controlmen.....	2	50	Gunner's mates.....	1	100
Boatswain's mates.....	7	42	Water tenders.....	2	100
Aviation machinist's mates.....	88	40	Buglers.....	1	100
Torpedomen.....	3	33	Enginemen.....	2	.00
Quartermasters.....	3	33	Shipfitters.....	1	.00
Pharmacist's mates.....	16	25	Coppersmiths.....	1	.00
Aviation ordnancemen.....	8	25	Bakers.....	1	.00
Signalmen.....	4	25	Musicians.....	1	.00
Machinist's mates.....	17	23			

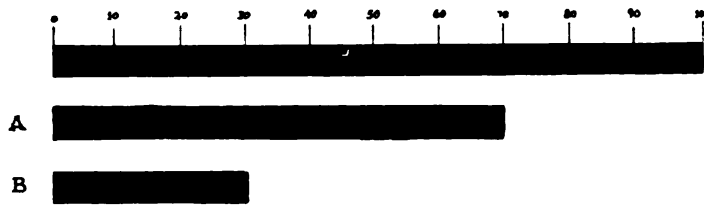
It was noted that seamen, second class, were only 10 per cent successful in completing training, while seamen, first class, were 29 per cent successful. This same condition prevailed in the other enlisted men of lower ratings, and the examiners came to the conclusion that the inability on the part of the individuals to qualify was to a great extent due to their immaturity, lack of service experience, and relatively poor balance. In other words, many of these men did not appear to be chief petty officer material.

CONCLUSIONS

The psychological method of elimination should be used as a routine measure for the elimination of poor aviation material; the examiners refer to those individuals who are graded 2.3 or lower as poor types.

The percentage of correct psychological estimates in this group is shown by Figure VII to be 75 per cent. While 51 individuals in this group actually qualified, a very large number of these required extra instruction in order to do so. In addition, as shown in Figure IV, those qualifying had a crash rate twice as high as any group of Navy fliers yet estimated. All of which indicates that few if any desirable pilots were obtained from among those of the lower psychological ratings. It is evident from the study of those candidates falling in the border-line group, those graded 2.4 should not be eliminated by psychological examination, but should be granted the privilege of starting training. Though in this group the psychological predictions were 63 per cent correct, it is felt that some good material might be saved by continuing the present practice of elimination by trial.

**A GROUP OF 212 OFFICERS AND MEN SELECTED BY PSYCHOLOGICAL EXAMINATION
FROM A TOTAL OF 628 INDIVIDUALS AS BEING GOOD AVIATION MATERIAL —**

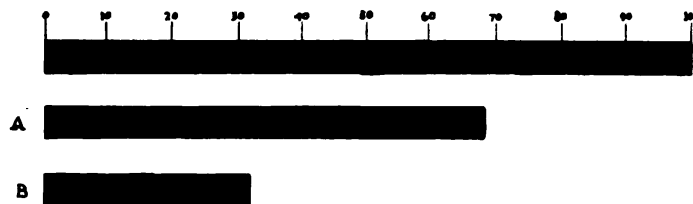


A- 148 individuals of this group (70%) qualified as
Aviators or Pilots

B- 64 individuals of this group (30%) failed to qualify

FIGURE I

**A GROUP OF 416 OFFICERS AND MEN SELECTED BY PSYCHOLOGICAL EXAMINATION
FROM A TOTAL OF 628 INDIVIDUALS AS BEING POOR AVIATION MATERIAL —**

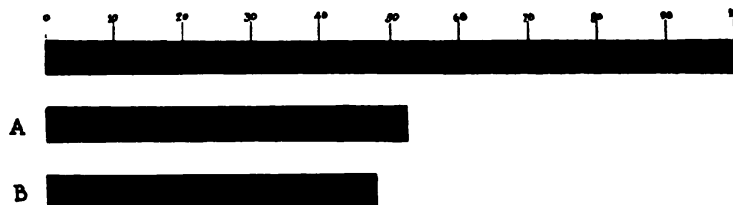


A- 281 (68%) Failed to qualify as aviators or pilots

B- 135 (32%) Qualified

FIGURE II

**A GROUP OF 135 OFFICERS AND MEN WHO WERE SELECTED BY
PSYCHOLOGICAL EXAMINATION TO BE POOR AVIATION MATERIAL
WHO QUALIFIED AS NAVAL AVIATORS OR PILOTS**



A- 71 of these (53%) qualified without extra instruction

B- 64 of these (47%) required extra instruction to qualify

FIGURE III

ANALYSIS OF CRASHES

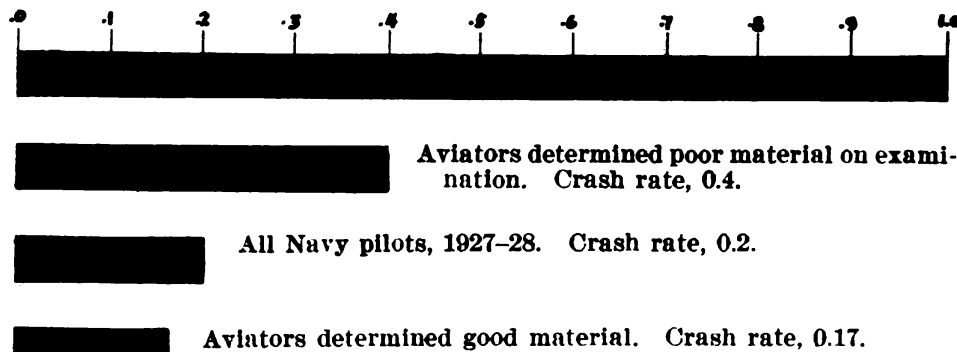
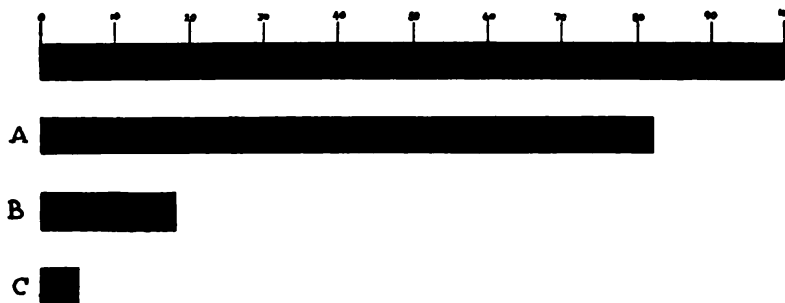


FIGURE IV

A GROUP OF 59 OFFICERS WHO WERE SELECTED BY PSYCHOLOGICAL EXAMINATION AS POOR AVIATION MATERIAL, BUT WHO QUALIFIED AS NAVAL AVIATORS



- A- 48 of these (82%) failed to qualify for combat flying
- B- 11 of these (18%) qualified for combat flying
- C- 3 of the total number (5%) have since been lost to aviation,
(2) two by crashes and (1) one by reason of being inapt

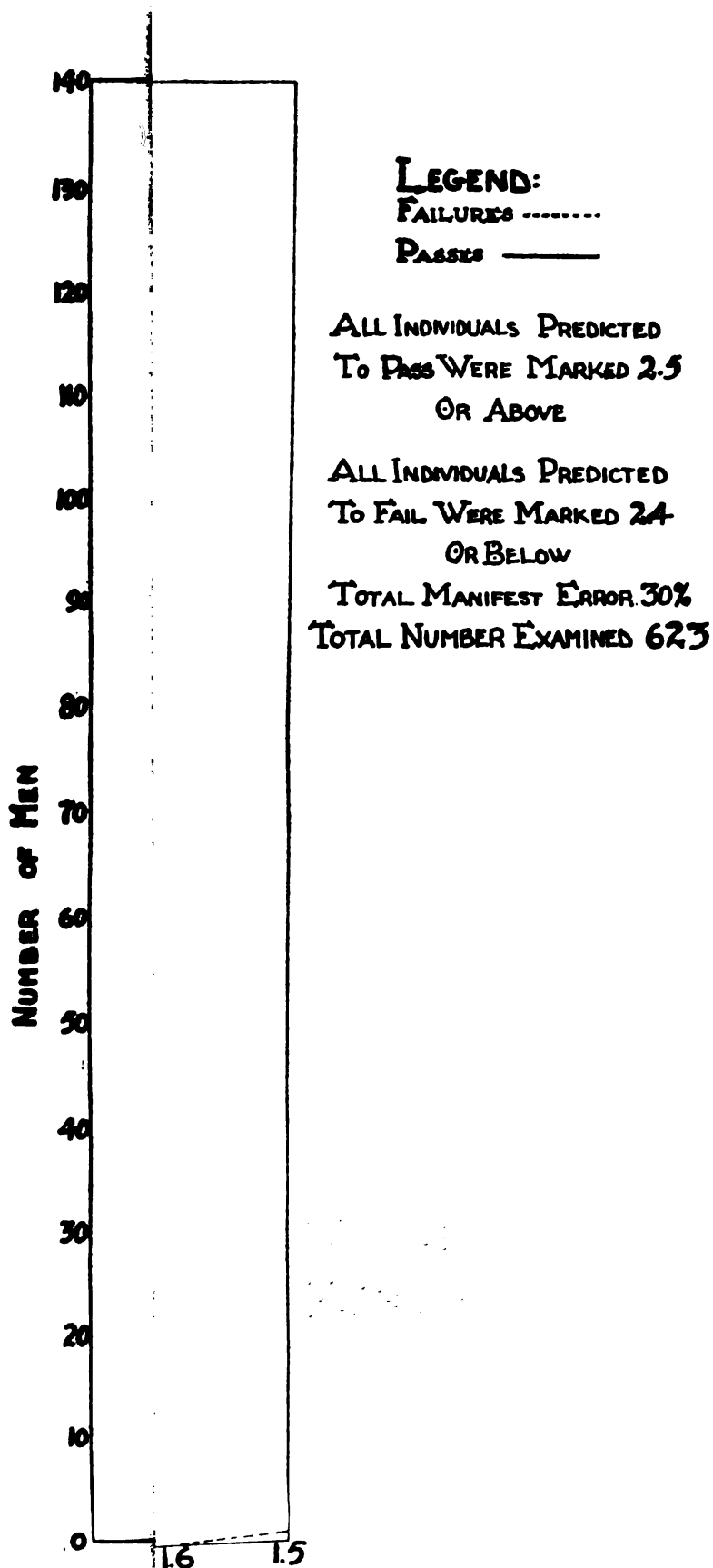
FIGURE V

THE GROUP OF 53 OFFICERS AND MEN SELECTED BY PSYCHOLOGICAL EXAMINATION AS BEING POOR AVIATION MATERIAL AND GIVEN A MARK OF 2.3 OR BELOW WHO QUALIFIED AS NAVAL AVIATORS OR PILOTS



- A- 35 individuals (66%) of these required extra instruction in order to qualify as aviators or pilots.

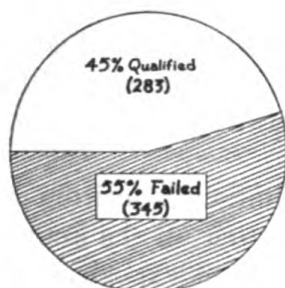
FIGURE VI



There is a definite type which can, almost without error, by psychological examination be said to be good material for aviation. This is shown in Figure VII, which indicates that none of those of high ratings failed to qualify.

The examiners are of the opinion that the final figures confirm their original supposition that stability is the necessary trait, above all others, for an individual to possess in order to be considered good aviation material. The psychological examination form was constructed with this belief in mind, and by pursuing this theory, the examiners were 70 per cent correct in their predictions under varying conditions of training as to success or failure. It was apparent to the examiners that only average intelligence and concentration were necessary for success in aviation training, while it is realized that those of higher intelligence are more useful military aviators.

**RESULTS OF ELIMINATION AT
PENSACOLA BY ACTUAL TRAINING ON
A GROUP OF 628 INDIVIDUALS**



**ESTIMATE OF RESULTS HAD
THE PSYCHOLOGICAL METHOD
OF SELECTION BEEN USED**

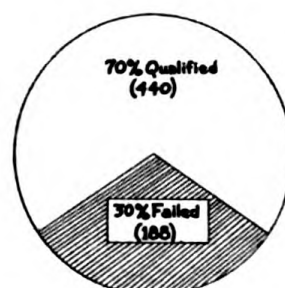


FIGURE VIII

Reaction time itself, as determined by the domino test, was found to be of no prognostic value. On the other hand the test was of value in bringing out psychological factors which could not always be determined in the short time allowed for the personality study.

It was also observed that those students who reported for training during the spring and summer months had less obstacles to contend with than those who trained during the winter months.

The rougher air and water, and the cold weather encountered during the latter period, makes it necessary for the student to be of a better balanced type, in order to qualify at that time.

While the psychological examination as determined upon leaves much to be desired, there is no reason why the form can not be de-

veloped into a more accurate and positive means of selecting aviation personnel.

As a result of their efforts and observation of the training system at Pensacola, the examiners arrived at the opinion that thorough standardization of flight-teaching methods would result in greatly increasing the value of psychological estimations. Steps in this direction have already been made at Pensacola.

The selection of candidates for aviation training by careful psychological examination would result in a tremendous saving to the Government, since, aside from the actual training costs of the failures, there is involved the cost of transporting the individual to and from his last station of duty to Pensacola.

It was recommended that a number of medical officers be trained especially in this work, before inaugurating the proposed plan to eliminate poor material at the source of application.

REFERENCE

- (1) Sutton, D. G. "Psychology in Relation to Aviation." An Unpublished Paper, 1930.

REPORT ON THE INTERNATIONAL HYGIENE EXPOSITION, DRESDEN, 1930

By C. S. BUTLER, Captain, Medical Corps, United States Navy

The Navy representative to this exposition arrived at Dresden August 11 and remained until September 1. During this period there was opportunity to observe the several features of the exposition with a fair degree of completeness.

Objects of the exposition.—In 1911 a similar exposition was held at Dresden with the object of bringing together all the knowledge of that date appertaining to hygiene. The present exposition extended the material of that first one and made provision for keeping this abreast of the times in a permanent building known as the German Museum of Hygiene. The object of this museum is thus stated by one of its principal promoters: "The Hygiene Museum is to be a center of instruction for the whole population, in which everyone by observation can acquire knowledge which will enable him to lead a sensible and healthful life." It is our opinion that this object is being attained and that the museum is indeed a center, not only for the popular teaching of hygienic living, but also through its technical staff, for devising the best methods for the teaching of hygiene by medical men throughout the world.

This museum differs from other similar institutions in the aggressiveness of its methods of dispensing a knowledge of hygiene. It is not a museum in the sense of being a place to display apparatus or anatomical specimens, but it is a dynamic agency for teaching the best means of attaining and preserving health and prolonging life. The museum has established connections with institutions engaged in

diffusing a popular knowledge of hygiene in other countries and it is a part of the plan of those who direct it to extend its methods to all countries throughout the world.

The official opening of this museum gave Dresden an opportunity to promote the 1930 exposition in which other nations were asked to participate. The extent of this participation was considerable and the exhibits occupy a large space in a special building. In quality these varied all the way from a few pictures scattered upon the wall to demonstrations having considerable educational merit.

The grounds of the exposition occupied a large area of probably 1 square mile. There were many displays of commercially manufactured articles having to do with hygiene and surrounding usually a nucleus furnished by the museum. These were units not under the roof of the museum of hygiene itself which had entire or partial importance from the standpoint of hygiene. Of these we would mention: (a) The model hospital, which was complete in every detail and department from its obstetrics ward to Röntgen ray diagnostic plant and bronchoscopy unit. Nothing was omitted of up-to-date equipment that is a part of a modern hospital.

(b) The motor unit devised to give popular instruction by means of an automobile specially equipped for the purpose. The museum will furnish these motor units equipped as desired by institutions or governments at a reasonable cost.

(c) The model farm and subsidiary unit, a dairy farm.

(d) A most instructive addition in our opinion was a model swimming bath, constructed according to the German views as to how best to profit by sunshine, air, and water, in the bath. In addition to the commodious swimming pool, apparatus for exercising (horizontal bars, parallel bars, etc.) and long platforms for taking the sun are provided. Many from long exposure to the sun, are quite black like a Malay. Except for their blue eyes and sunburnt hair, many might easily be mistaken for colored people.

The several features just referred to are but small satellites when compared with the central sun of the exposition, the German Museum of Hygiene, which will be described a little in detail, though it should be said here that if one attempted any extended treatment of the museum it would be difficult to know where to stop, as there is so much that is new, or, if not new, is so well done as to make it worthy of description for this reason alone. A general description of the museum will be given and a few detailed examples of the methods used there to teach hygiene to the man in the street.

The accompanying photograph shows the main building of the German Museum of Hygiene. There are three main floors for the displays each wonderfully lighted by daylight. A wing on either

side of the main entrance gives office space on the one side to medical men who plan the displays and act as technical directors and on the other side to those who manage the business affairs of the museum. In the basement of the big building are the workshops in which are made the wax and celluloid models, the inlaid wood models of different parts of the human body, the wonderful injected and cleared specimens of anatomical parts prepared according to the technique of Professor Spalteholtz and the many other units which constitute the output of this unique manufactory.

In passing, it may be well to describe briefly what the Spalteholtz process is because in the museum above these workshops are scores of these specimens. Indeed much of the load of teaching anatomy to the layman is by means of these specimens. Briefly, the process consists in injecting the veins and arteries of an organ or member with blue and red injection material, respectively, and then subjecting the specimen to a clearing procedure which gives all other tissues a rich amber colored transparency. The specimen is retained rigidly in position in the demonstration jar filled with a fluid (probably methyl salicylate) which maintains this clear transparency. To compare one of these beautiful specimens with the best product of other processes is like comparing a steel engraving with a crude wood cut.

The technicians who make this museum material work in conjunction with the medical men who have planned the particular feature, anatomical part, or problem to be shown. There are artists, wax workers, carpenters and men of other callings engaged in this work. It must have taken many years to attain the skill which they demonstrate in their output.

The first floor of the museum proper is devoted to giving the visitor, by charts, pictures, wax models, illuminated microscopical sections, transparencies and in other ways too numerous to mention, some idea of the structure of man. The structure of the cell, the collection of cells into tissues and of tissues into organs is developed so thoroughly that any adult of ordinary intelligence who would devote the time necessary to read the legends and get the lesson which is intended for the particular item, would not only get an excellent idea of the structure of man, but would be increasingly interested in seeing a knowledge of this wonderful machine unfold itself.

In going through the demonstrations on this first floor, where the medical profession of Germany has given to the layman such a wonderful chance to grasp the complicated structure of man, the thought came to the writer that if our big medical centers had such

a museum where the medical student could build his knowledge by looking at the thing rather than by reading about it, how many weary hours of study it would save, and how much better would be the student's grasp of anatomical structure and physiological function.

The second floor of the museum is devoted to biology, anthropology, and physiology. The evolution of man, certain considerations of racial anatomical differences and geographical distribution of races of man are shown here. In a side room on this floor is a section called "Mother and child." Here by the teaching methods used elsewhere in the museum the complete cycle of development of the child is shown. From the fertilization of the ovum in the fallopian tube of the female by the spermatozoon of the male through the development of the child in utero and the several stages of labor, the whole process is shown and well shown. In this same room were shown also interesting photographs and apparatus illustrating the development of the art of obstetrics. Ancient obstetrical chairs, old forceps and a portrait and brief history of that great benefactor of mothers, Ignaz Philipp Semmelweis, were here shown. Such historical features serve to make more interesting the demonstration as well as to make the lesson stick in the memory. The writer was interested to see that German parents had no apparent aversion to showing their children through this unit.

On this same floor are shown the application of the law of inheritance (Mendel's law) to animals, plants, and man. Hygiene education showing the various means of education of the public in health measures (health propaganda), nutrition and digestion, foods, their composition and assimilation and the several food deficiency diseases constitute other features of the museum's second-floor exhibits. The writer failed to see here any consideration of the food-deficiency disease, pellagra, nor any indication of an understanding of the importance of Goldberger's work in the prevention and cure of this important disease. Other food-deficiency diseases such as scurvy, beriberi, and rickets were adequately explained.

The third floor of the museum may be considered as the place to connect up the knowledge gained of structure and function from the exhibits and lessons of the first and second floors with a practical understanding of how different diseases are acquired, their symptoms, diagnosis, and treatment. We will take, as showing the method of approach to diseases in general, the plan used to give the layman an understanding of the venereal diseases. The genital lesions of each of the three venereal diseases—gonorrhea, chancroid, and syphilis—are shown for both the male and female; subsequent symptoms and complications are shown by means of charts and

pictures which may be illuminated by pressing an electric button. The several skin eruptions of syphilis are adequately shown and some of the manifestations of congenital syphilis. The cause of each is demonstrated by means of illuminated photomicrographs and the means of diagnosis in each case. In this connection we were interested to see that an excellent idea of the complicated Wassermann reaction for diagnosing syphilis could be acquired by one of the demonstrations in this room.

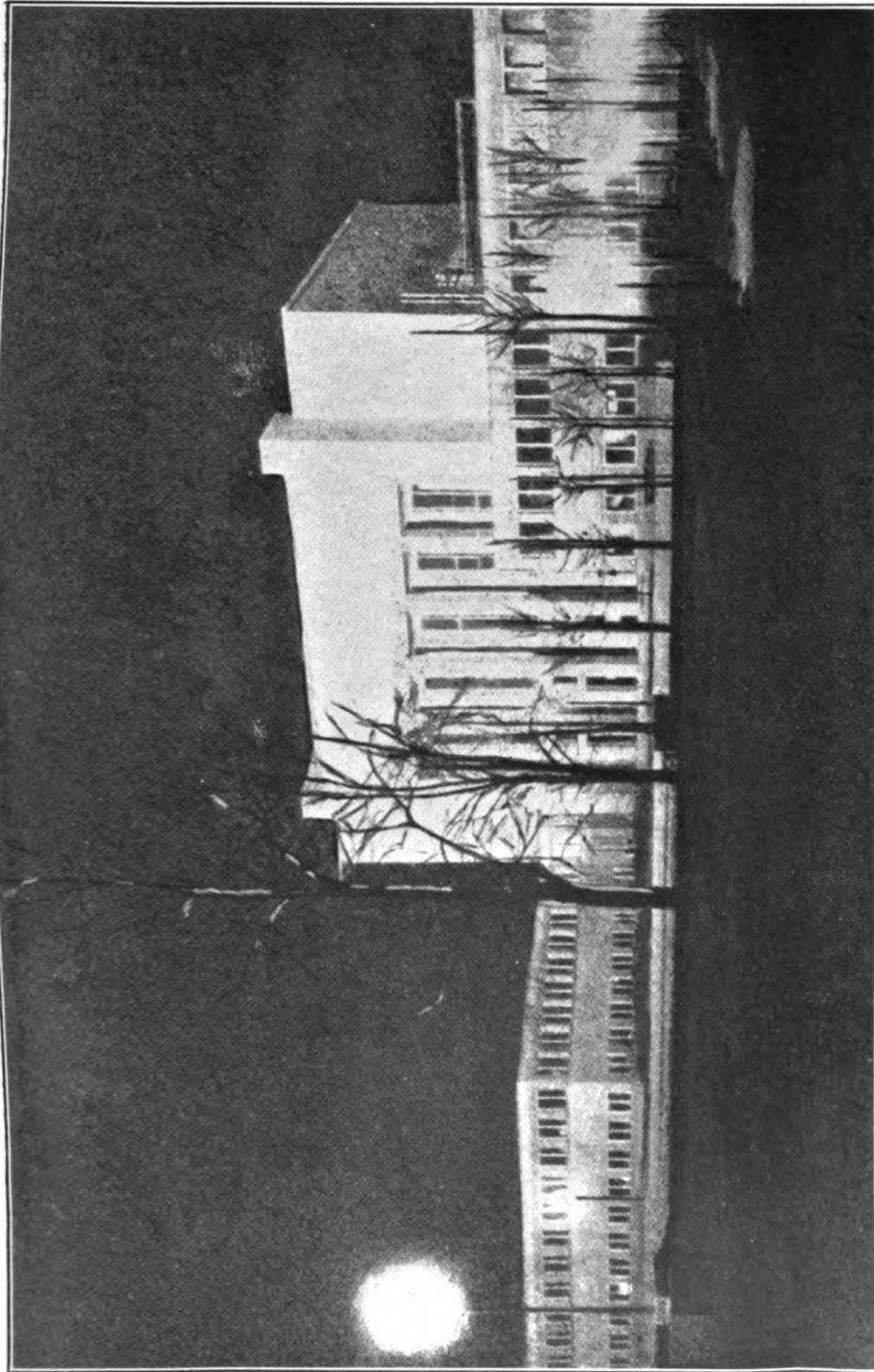
After this were figures showing the incidence of these diseases in the German population and the approximate money damage caused per case. The chief events in the history of the venereal diseases from the time they were undifferentiated down to the present with the names and pictures of the physicians responsible for the discoveries and advances all are given in historical sequence. It is a most complete and gripping demonstration of the whole subject and is a good instance of the frankness with which the museum authorities have met their public with a serious and successful attempt to give present knowledge of a rather intricate and involved section of medicine to the people.

Many other diseases are treated in this same comprehensive manner. Tuberculosis, smallpox, typhoid fever, cancer, the animal parasitic diseases, and diseases common to man and animals are all systematically shown.

This floor also contains the historical department, showing living conditions in man's prehistoric period (housing conditions, tombs, clothing, etc.) in Egypt, Greece, Babylon, the classic period of Greece and Rome, and mediæval conditions of life. Then follows a demonstration of living conditions in different countries in our own time and of the hygiene of primitive peoples.

The above is but a very brief outline of the extent of the museum's efforts to give the public an adequate idea of hygienic living in general. In addition, there are exhibits having to do with special features, e. g., the hygiene of the school, occupational hygiene, and the bearing of certain occupations upon the health of man and woman.

In closing, the writer desires to express his appreciation for the many favors received at the hands of the United States consulate at Dresden during the three weeks spent at the exposition. Consul General Arminius T. Haeberle and his entire staff did everything in their power to render our stay at the exposition both pleasant and profitable. It is a pleasure to attest to the efficiency of this office and to the popularity of Mr. Haeberle with the officials and people of Dresden.



GERMAN MUSEUM OF HYGIENE. DRESDEN EXPOSITION

SIMULATED DEAFNESS

By H. C. WEBER, Lieutenant Commander, Medical Corps, United States Navy

To the ear specialist in the military service feigned deafness is always a problem. Especially has this been so during and since the late war. Applications for compensation, disability allowances, or pensions are numerous, and the validity of the claims is not always easy to prove or disprove. The work involved requires much patience, persistence, skill, and self-control. Experience here as elsewhere is the best teacher.

In this article the examination as conducted in the ear department at the United States Naval Hospital, Great Lakes, Ill., is described. Some of the well-known tests have been omitted, because they are not practicable in naval work. All the tests need not be used in every case. A test suited for one case may not be applicable to another at all. Some patients may have learned or may have been prompted in certain of these tests; therefore, recourse may be had to others given. But it is believed that a sufficient number of tests have been mentioned to trip almost any malingerer feigning deafness.

The examiner and the assistants should be sympathetic and encouraging to the patient. They should try to instill confidence and should not from the beginning arouse the suspicion of the examined. The assistants should be cautioned not to divulge by their facial expressions or actions that the examiner has detected the faker. They should be asked not to try these tests for their own amusement or of their own accord simply, because many of the tests are very readily understood and learned by the examined. One should always keep in mind that it is a problem of the examiner's wits against the malingerer's. The assistants should be cautioned not to talk about the result of the tests either to the examined or other people. Precautions should be taken that the malingerer has not access to the records of his case. As learned by experience the malingerer will try to find out from the assistants or the examiner himself how he fared in the various tests; he becomes very solicitous.

Deafness is simulated either in one or both ears. Up to this time the writer has not had a case of feigned total deafness. When total deafness is claimed a prolonged observation is absolutely necessary, and the patient should be under constant watch of trained assistants or hospital attendants. Of objective tests perhaps only the labyrinth tests are of any avail in this event. Fortunately for the examiner it is so extremely difficult for the malingerer to carry out the rôle of complete deafness that this is not often if ever attempted. It is presumed that the patient has some vestige of hearing, either unilateral or bilateral, and that it will be the problem of the examiner to prove that hearing is good in both ears or that hearing is

much better than admitted. Attempts at falsification if detected are positive evidence. Our evidence is considered either presumptive or positive.

Before proceeding with the tests proper, one should take a careful history, both general and special. Family history is of importance on account of otosclerosis and other forms of deafness. Syphilis and other systemic diseases should be ruled out as it is possible that they may have involved the eighth nerve. Paralysis, especially of the facial nerve, should be ruled out. One should pin the patient down with general and specific questions. One should inquire very minutely into the history of previous diseases, especially those that may have affected the ears, as scarlet fever, measles, influenza, and others. One should ask the patient whether he ever had anything wrong with his ears, nose, or throat, and when and where this happened. Usually the malingerer will give an evasive answer when questioned as to whether or not there is an entry of otitis media or running ear in his health record. An officer told the writer that he had a sore and running ear for two weeks while he was a passenger on an Army transport and that there was no Navy medical officer available to treat him and that therefore no entry was made in his health record. One should inquire as to the exposure to prolonged and heavy gunfire, and as to submarine and diving duty, flying, or work in a boiler shop. It might be stated here that the man who selects to mangle does not usually volunteer for hazardous work. He is not that enterprising or courageous. After this history has been taken, review it with the patient and ask him whether he has anything to add, so he can not contradict himself later.

All during the examination the patient's attitude, gestures, mannerisms, and emotional reactions should be studied and made note of. They are very characteristic as a rule. The malingerer will crane his neck forward, cupping his hand behind his ear, eyes staring and intently turned to whoever addresses him, especially when trying to impress some one, as for instance, the commanding officer. Some betray their nervousness by repeated swallowing, blinking, increased respiration, perspiration, blushing, and wringing of hands, or a display of bad temper. Ask them about their eyes, whether or not their eyesight is failing; they usually claim to have something else wrong. It is the custom to ask a recruit whether there is anything wrong with his eyes, ears, or color perception.

A general examination should include examination for syphilis, Romberg test, past pointing, ataxia, and nystagmus. Laboratory procedures should be done routinely. X ray of mastoids is essential in most cases.

The special examination of eyes, ears, nose, and throat should be done most thoroughly. Abnormalities of the throat and nose, includ-

ing the Eustachian tubes, should be carefully looked for. The sinuses should be examined and X rayed if indicated. Evidence of previous mastoid operations should be searched for. The ear canals should be studied and the drums examined with the utmost scrutiny as to luster, perforations, discharge, inflammation, thickening, retraction, scars, and deposits of calcium salts. One of the most important indications of former trouble is a break in, or the absence of the cone of light. By this is meant the triangular area of the drumhead resembling oiled tissue paper which extends from the end of the handle of the malleus downward and forward. However, one should not place too much importance on so-called retraction, thickening, and changes in the cone of light as one is surprised at the acute hearing one finds in spite of all these objective findings.

Then one proceeds to the hearing tests proper. Some of the test should be frequently repeated to determine discrepancies between the results obtained at various times. It will be found that the malingerer's memory fails him disastrously, especially if he be subjected often to a multiplicity and variety of tests. Confusion is half of the game.

A distinction is made between conduction deafness and nerve deafness, depending on whether the conduction apparatus or the perception apparatus is involved. The conduction apparatus includes the pinna, the ear canal, ear-drum, and chain of ossicles. The perception apparatus starts at the oval window in the vestibule and ends in the center for hearing in the brain. The semicircular canals are so intimately associated with the perception apparatus that the two may be considered as one, and if one is involved the other will

Then one proceeds to the hearing tests proper. Some of the tests which, if giving normal response, proves that the perception apparatus is functioning and that there can be no nerve deafness of the ear examined.

It may not be amiss to describe shortly the tests as used in this hospital. The examination is conducted as follows: After a careful history has been taken as given above, the drums, canals, mastoids and Eustachian tubes, nose, and throat are examined. The hearing for spoken voice—eyes open—and for whispered voice—eyes open—is then determined to see what the patient will admit. After this the tuning forks and Galton whistle are used while eyes are unbandaged to see again what the patient admits in regard to them. Usually the patient gives honest responses to tuning fork tests, because he is not acquainted with these and does not know the import of them. However, one should remember and keep constantly in mind that, to succeed, a malingerer will go to any length to accomplish his purpose and that many of these people have been

coached. After establishing the above-mentioned preliminaries one can visualize one's problem and devise a method of attack.

In this paragraph is briefly mentioned what the normal findings for tuning forks are. A set of Hartmann tuning forks which have been tried on numerous normal individuals for purpose of standardization is used. In regard to the Galton whistle it would be appropriate to state that those on the market differ greatly as to pitch and adjustment; therefore, it should also be standardized. First the low tone limit is determined starting with C-16 fork; after striking it gently against the palm of the hand it is held close to the external meatus. If the patient admits hearing this, it is marked down as: Low tone limit C-16. If he claims he can not hear the fork, one takes the C-32 fork, and so on up the scale, until we have the low-tone limit established for each ear separately. Next one tests for the high-tone limit with the Galton whistle. A start is made at zero opening, and gradually the barrel of the whistle is unscrewed until the patient admits hearing the whistle. The results are tabulated for each ear separately, closing the ear not being tested during the examination. For purposes of record one marks down how many turns on the whistle it took before the patient admitted hearing the sound; for instance, if it took half a turn of the barrel one marks this down as: High tone limit 0.5 turn on Galton whistle. For normal ears it takes 0.3 turn on the instrument available here.

This test is followed by air conduction tests. By this is meant the length of time which a sounding tuning fork held before the external meatus is heard. A C-256 fork of the Hartmann set is used. The time recorded extends from the second the fork is hit until the patient does not hear it any more. The normal for our fork is 45 seconds; so if the patient admits hearing it 45 seconds, it is marked down as air conduction 45/45. If he admits hearing it less than this time, say 30 or 10 seconds, it is noted as 30/45 or 10/45. Each ear is tested separately, although the patient may admit normal hearing in one ear. Air conduction is decreased in both conduction and nerve deafness.

Bone conduction is next examined with the same fork. After hitting the fork, the handle of it is held over the mastoid near the antrum. The time is again taken from the second the fork was struck. The normal on our fork is 16 seconds. So if the response is normal it is marked down as bone conduction 16/16. Bone conduction is increased in conduction deafness and decreased or abolished in nerve deafness.

From the air and bone conduction the Rinne test is readily calculated; for instance, if the air conduction is 45/45 and the bones conduction is 16/16 the numerators of these two fractions are taken; the

numerator of air conduction is made the numerator, and the numerator of the bone conduction is made the denominator of a new fraction which expresses the Rinne test. If the numerator of the new fraction is larger than the denominator, the Rinne is positive. The Rinne test is negative or neutral in marked conduction deafness. Whenever air conduction exceeds bone conduction the Rinne test is considered positive; when the reverse holds, the Rinne is negative.

The Weber test is performed by holding the handle of a sounding tuning fork somewhere in the midline of the skull, either on the vertex, center of forehead over the glabella, or at the middle of upper teeth. The patient is asked as to which ear perceives the sound clearest. The malingerer will almost invariably refer it to the healthy ear. If there should be conduction deafness, it should lateralize to the bad ear. If there is complete nerve deafness in one ear, this test of course will lateralize to the good ear. By holding one of his own ears shut and trying the test on himself, the examiner can easily learn the mechanism of it.

One proceeds on the list with the whisper test, eyes open. Although the Navy considers 15 feet the normal distance at which a whispered voice can be heard, it is a well known fact that in a quiet room and under favorable circumstances this distance can be increased readily up to 30 feet. Our examination is conducted as given in the Manual of the Medical Department, but one should not be satisfied if the patient admits a distance of 15 feet only. Usually the normal will get at least 25 feet.

The hearing acuity for the spoken voice with eyes open is then examined. The Veterans' Bureau considers 20 feet the normal distance at which the ordinary conversational voice should be heard. We are never satisfied with anything less than 40 feet. In very glaring cases the patient is taken to a vacant ward where ample space is available; distances up to 75 and 80 feet can be readily obtained provided the hearing acuity for conversational voice is normal. In our own tests for purposes of comparison 40 feet is considered the normal. The result of a certain test is expressed as being 20/40 if patient admits hearing the spoken voice at 20 feet. The examiner purposely subdues his voice as much as possible without making it a whisper.

With the foregoing data on hand the preceding findings are reviewed to get a clear conception of the problem that the case in hand presents. Experience will teach which particular malingering tests to use. Needless to say the examiner should have an idea as to what to expect in the normal, in conduction deafness, and in nerve deafness.

Having satisfied ourselves in our own mind that the patient is a malingerer, the tuning-fork tests for air conduction and bone conduc-

tion while the patient is blindfolded are done. The C-256 fork is used for this again as before. But instead of sounding the fork by striking it against our hand we squeeze the prongs together and then release them suddenly, taking care not to produce any noise, so as to prevent the click when striking the hand from being heard by the patient. After waiting, say about 10, 15, or 20 seconds, a C-128 fork or another C-256 fork is struck against the hand to convey the impression to the malingerer that this is the fork which is placed in front of the meatus. As a matter of fact the second fork is discarded immediately. The first fork which is still sounding is held near the external auditory meatus of the ear under examination. The patient, if versed with tuning-fork tests, will quietly count to himself the number of seconds he should admit hearing the fork. However, he does not take into account the 10, 15, or 20 seconds the first fork has vibrated before being placed near his ear. Therefore, the actual time that the first fork has been vibrating is from 10 to 15 or more seconds longer than the patient thinks it is. For example, if the first fork (the fork actually used for the test) is struck when the second hand of the watch is at 60, the second fork is struck at 20 seconds and the first then placed near the meatus. If the patient hears this first fork vibrating until the second hand is at 45 on the dial, it is apparent that the patient's air conduction is really 45 instead of 25 seconds. This test was devised when it was found by experience that patients were counting the seconds mentally. Bone conduction is then tested in the same manner. If the patient is malingering, there are always great discrepancies.

If from the foregoing examination it is concluded that the patient is simulating deafness in one or both ears, the cold caloric test comes in handy. An ordinary irrigating can fitted with rubber tubing and a very blunt eye dropper is used. Of course, it is necessary that ear-wax and other obstructions in the canal have been removed before. The temperature of the water is reduced to 65° F. The irrigating can should be raised to about 1 foot above the patient's ear. The water is then permitted to run in and out of the canal to cool the endolymph in the semicircular canals. The time is taken when the irrigation began, and the irrigation continued for 5 to 10 seconds after the nystagmus begins. The nystagmus will be to the left if the right ear is irrigated and vice versa. Past pointing and the falling tests can also be employed while the patient is in this condition, but they are not necessary as the nystagmus proves that the patient's inner ear is alive, and that there can not be complete nerve deafness. If complete bilateral deafness is claimed, both ears should be irrigated.

The coin-click test is a useful test. It is described in the manual of the Medical Department of the Navy. We have for years used a variation in that the patient is blindfolded and three examiners are employed. The first examiner is placed at a distance at which the patient counts the number of clicks correctly when his eyes are open. The second examiner stands about 15 feet farther away and the third examiner about 20 feet from the second examiner, so that if the patient admits hearing the clicks when eyes are open at 10 feet, the examiners are stationed at 10, 25, and 45 feet, respectively. All are instructed that they should strike their coins together as many times as the first examiner does. This should be done in rapid succession to give the impression that only one examiner is striking the coins together. The patient is to count the total clicks he hears. If he counts the correct total, it is positive evidence that the patient is malingering. If the patient counts only the first examiner's clicks, the second, or, even better, the third, examiner should be signaled to click his coins alone, No. 1 and No. 2 examiner remaining quiet. In nearly all cases of malingering the patient gets so confused that he is exposed by this trick, as he is not able to see who is hitting the coins together. As a matter of fact some malingerers stated that the clicks were heard much louder when the third examiner alone struck his coins together.

Next the patient is examined for the whispered voice with eyes bandaged. For bandaging or occluding the eyes we use two black eye patches under which cotton or gauze is placed to make doubly certain that the patient does not see. The bandages should be thoroughly inspected. If his admitted hearing acuity for whisper is less than 3 feet, this test is no good, because the patient can judge the distance of the examiner; he can feel him, so to speak. If he admits hearing the whisper at 5 feet or more, we employ a dummy or decoy whose part it is to walk back and forth in the direction of the patient, taking one step after each number or two has been whispered, shuffling his feet, and purposely misleading the patient as to the distance of the examiner. The dummy should not get any closer than 5 feet while this is being done; the examiner who urges the patient to repeat the numbers or words he whispers withdraws rapidly farther and farther away. It may be necessary for the examiner to remove his shoes, the idea being that only the dummy's walking should be heard by the patient. The hearing acuity for the spoken voice is then tested in the same manner as described. Inasmuch as the patient usually admits hearing the spoken voice, the test is more easily applied for spoken voice. The decoy should not get any closer than about 8 feet from the patient when testing the spoken voice.

When complete deafness in one ear is claimed, the Lombard test is used. The patient is made to read a book aloud and the Barany noise apparatus is sounded in the patient's good ear. If he is actually deaf in the bad ear, he will raise his voice louder and louder until he almost shouts. If he is malingering he will not raise his voice as he hears his own voice in reading through the so-called good ear. The examiner can imitate conduction deafness by closing one ear tightly and sounding the noise apparatus in the other ear. He will be compelled to raise his voice in reading.

The stethoscope test is very useful for detection of simulated deafness in one ear. An ordinary stethoscope with phonendoscope attached is adjusted in both ears of the patient. A stethoscope with 6 feet tubing is also used. The examiner either blindfolds the patient or stands behind him. He taps the diaphragm lightly, asking the patient to count the number of taps he hears. It is very important that both tubes should be open for the first few trials as this will prevent the patient from orienting himself. After several trials, the patient counting the taps correctly, the tube leading to the good ear is pinched tightly closed. If the patient still counts correctly, he hears in the bad ear.

The Lombard and the stethoscope tests are not of much help to us in our line of work, as it is necessary to prove that the patient can hear at specified distances. Therefore, in cases where one ear has normal hearing, use is made of the knowledge that the normal ear will perceive and recognize sounds at about half its normal distance or a little less, although this good ear be tightly closed. The examiner can easily convince himself of this by tightly closing both ears and having an assistant call off numbers to him. So if the malingerer has one good ear and lets the examiner approach him until he is right up to him, it is positive proof that the patient is practicing deception. This test is also applicable to both the whispered and spoken voice.

An officer was examined who claimed to hear the whispered voice not beyond 1 foot in the right ear and 4 feet in the left ear. At first this seemed an insurmountably difficult problem to solve. He answered up normally to all tuning-fork tests when first admitted until he got better acquainted with them.

The case record is given in full below: Admitted with diagnosis undertermined on January 22, 1925. The patient stated that his hearing had been bad to this degree for the last two years. He could not ascribe any cause for the defective hearing. He was not on the sick list with any acute illness since his examination for a commission in 1920. At that time his hearing was 15/15 for whisper in both ears.

Family and previous history were negative. He denied venereal infections. Wassermann was negative. He had not had a severe "cold" in years. There was no history of otitis media. He was not exposed to heavy gunfire and had not been detailed to submarine or diving duty. There was no entry in his health record in regard to inflammation of ears. The patient tried to read the record of his examination when the examiner was absent and only the corpsman was present. After the examination he inquired from the corpsman as to how far the examiner was from him when the voice tests were being made.

Examination: There was no pathology of either ear drum, except perhaps a faint suggestion of dullness of the cone of light of the left ear drum. He admitted that the left was by far the better ear. Low tone limit was not raised. Heard C-32 fork with either ear. High-tone limit was not reduced. Heard all tuning forks in Hartmann set and Galton whistle at 0.3 opening in both ears. Air conduction tested with C-256 fork: Right ear, 45/45; left ear, 45/45. When this was again tried several days later he would not admit any more than 25/45 for either ear. His eyes were then bandaged, the C-256 was sounded by squeezing the prongs, and another fork struck as mentioned under explanation of tests. His air conduction was again 45/45 for both ears. Bone conduction was 16/16 for both ears. Rinne test was positive for both ears. Weber test lateralized to the supposedly better ear, i. e., the left ear.

Coin-click test:

	First day	Second day	Third day
Right ear.....	6 inches.....	3 feet.....	3 feet.
Left ear.....	5 feet.....	10 feet.....	10 feet.

Coin-click test, eyes bandaged, three examiners stationed, respectively, at 5, 25, and 45 feet as described above: Right, 3 feet; left, 45 feet.

If the patient admitted hearing the clicks at 45 feet with the left ear, he should have admitted hearing the clicks in the bad ear at least at 20 feet, although the right ear were deaf, because he heard with the closed good ear. But he refused to hear until the examiner was again as close as 3 feet from him.

Whisper—eyes open:

	First day	Second day	Third day
Right.....	1/15.....	1/15.....	1/15.
Left.....	8/15.....	10/15.....	12/15.

Whisper—eyes bandaged :

	First day	Second day	Third day	Fourth day
Right.....	1/15.....	6 inches.....	3/15.....	6 inches.....
Left.....	12/15.....	9/15.....	18/15.....	25/15.....

Spoken voice—eyes open :

	First day	Second day	Third day	Fourth day
Right.....	10 feet.....	12 feet.....	15 feet.....	20 feet.....
Left.....	14 feet.....	15 feet.....	17 feet.....	20 feet.....

Spoken voice—eyes bandaged and with dummy as described before :

	First day	Second day	Third day	Fourth day	Fifth day
Right.....	22 feet.....	25 feet.....	38 feet.....	39 feet.....	65 feet.....
Left.....	16 feet.....	26 feet.....	38 feet.....	39 feet.....	70 feet.....

A story was made up containing easily understood words and numbers. The words in capital letters were whispered and words in small letters spoken. The examiner stood 15 feet from the patient and was therefore well within range of the admitted hearing acuity of the patient for the spoken voice. The eyes were bandaged. The story is given below. The patient was instructed to repeat the story word for word. His left ear was stopped because this was the better ear for the whisper. The idea was to trip him on the whispered words. He should at least have repeated the spoken words correctly. He did this for the first two sentences and then refused to cooperate. He remained silent for fear that he would repeat some of the whispered words. He blushed and trembled considerably. However, after the story was completed he was able to give the substance of the story correctly.

The story:

SIXTY-SIX MILES from New York, ON THE ROAD TO BUFFALO, we had an accident. FIFTY-FIVE PEOPLE were killed. TWENTY-SIX were slightly injured, FORTY-SEVEN badly frightened, AND SIXTEEN received severe injuries. THE FIFTY-FIVE KILLED were taken to the SIX UNDERTAKERS OF THE NEAR-BY CITY. The sixteen severely injured WERE TAKEN CARE OF BY FOUR DOCTORS in three different hospitals of the same city. SOME OF THE FRIGHTENED WOMEN felt that they were neglected.

Summary of case 1.—In reviewing this case the following facts stand out:

1. The absence of a history involving the ears.
2. The absence of entries in the health record.
3. The remarkably good health the patient had enjoyed.
4. The lack of chance for occupational deafness.

5. The complete lack of pathological findings on physical examination.

6. The positively normal responses to tuning fork tests and Galton whistle when first examined.

7. The attempt to deceive the examiner when tuning fork tests were again tried.

8. The marked discrepancies between voice tests, eyes open, and then eyes bandaged.

9. The discrepancies between the same tests conducted on different days.

10. The attempts to read his record and bribe a corpsman.

11. His complete silence after the second sentence of the story had been read.

12. The typical attitude of the malingerer and his emotional reaction.

13. Lack of difficulty in hearing when off guard.

14. Last but not least the difference between hearing acuity for whisper of left ear on first and fourth day; when last tested it was better than normal. It had improved from 4/15 to 25/15; no treatment had been administered. The patient had realized in the meantime that the rôle of bilateral deafness for whisper was too difficult to carry out. It was fatal to admit 25/15, because, although the left ear was closed, he should admit hearing the whisper at about 8 to 10 feet in spite of the fact that the so-called better ear (in this case the left) was closed. The same holds for the coin-click test.

The following four cases are given in parallel to illustrate what may be expected in (1) a patient who had a simple mastoid operation done only four weeks before, (2) a patient who had his right canal plugged with a large polyp and a profuse discharge from the right ear and who later had a modified radical mastoid operation performed, (3) a malingerer who showed some evidence of previous ear infection but who was grossly exaggerating his disability, (4) a malingerer who did not present any evidence of any previous trouble. The cases are numbered 2, 3, 4, and 5.

	Case 2	Case 3
Drums.....	R. healed, little thickening; L. normal.	R. concealed by polyp and discharge; L. scar and retraction.
Discharge.....	None.....	R. only.
Eustachian tubes.....	Patent.....	Patent.
Mastoids.....	R. simple operation 4 weeks ago; L. normal.	Mastoiditis, chronic, right side; L. normal.
Nares and sinuses.....	Negative.....	Rhinitis, chronic.
Tonsils.....	Are out.....	Enucleated.
Tuning fork tests; low-tone limit.....	R. raised to C-64; L. C-32.....	R. C-512 raised; L. C-64.
High-tone limit, Galton whistle.....	Both at 0.3 opening.....	R. 1.5 turn lowered; L. 0.5.
Air conduction C-256 fork.....	R. 30/45 in spite of recent mastoid operation, L. 45/45.	R. impossible; L. 15/45.
Bone conduction C-256 fork.....	R. 20/16 prolonged; L. 16/16.....	R. 30/16 much prolonged; L. 21/16 prolonged.

	Case 2	Case 3
Rinne test.....	R. positive 30/20; L. positive 45/16..	R. negative 0/30; L. negative 15/21.
Weber test lateralizes to.....	Right, the bad ear.....	Right, the bad ear.
Cold caloric test.....	Not done.....	Not done.
Coin click.....	R. 15/20; L. 20/20.....	R. 6/20; L. 10/20.
Paracusis Willisii.....	None.....	Yes.
Whisper, eyes open.....	R. 20 feet, L. 28 feet.....	R. 2 feet; L. 18 feet.
Whisper, eyes bandaged and use of dummy.....	Not done.....	Not done.
Spoken voice, eyes open.....	R. 34 feet, L. 40 feet.....	R. 6 feet, L. 28 feet.
Spoken voice, eyes bandaged.....	Not done.....	Not done.
Questions when off guard.....	Not done.....	Not done.
Insulting remarks.....	Not done.....	Not done.
Lombard test; noise apparatus in good ear.....	No increased tone of voice; normal.	Decided raising of tone and intensity.
Stethoscope test.....	Not done.....	Not done.
	Case 4	Case 5
Drums.....	R. retracted slightly; L. healed perforation.	Both normal.
Discharge.....	None.....	None.
Eustachian tubes.....	Patent.....	Patent.
Mastoids.....	Both negative.....	Both negative.
Nares and Sinuses.....	Negative.....	Negative.
Tonsils.....	Enucleated.....	Enucleated.
Tuning fork tests; Low-tone limit.....	R. C-64; L. hears no forks (?).....	R. C-512, raised; L. C-32.
High-tone limit, Galton whistle.....	Claims he can not hear whistle at all in either ear.	R. 1.0 turn; L. 0.3 turn.
Air conduction, C-256 fork.....	R. 17/45; L. none.....	R. none admitted; L. 42/45.
Bone conduction; C-256 fork.....	R. 7/16; L. none.....	R. 14/16, shortened; should be prolonged; L. 14/16.
Rinne test.....	R. positive, 17/7; L. 0/0.....	R. negative 0/14; L. positive 42/14.
Weber test lateralizes to.....	Right, but changes at will.....	Indefinite; fears to commit himself.
Cold caloric test.....	Irrigated left ear with typical nystagmus to right.	Typical nystagmus to left after irrigation of right ear.
Coin click.....	R. 13/20; L. claims he does not hear.	R. not heard (?); L. 20/20.
Paracusis; Willisii.....	None.....	None.
Whisper, eyes open.....	Does not hear in either ear.....	R. 1/15; L. 25 feet.
Whisper, eyes bandaged and use of dummy.....	No response.....	R. 1/15; L. 28 feet.
Spoken voice, eyes open.....	R. 1 foot; L. zero.....	R. 1 foot; L. 40 feet.
Spoken voice, eyes bandaged.....	No change.....	No change.
Questions when off guard.....	Answers at 20 feet.....	Not done.
Insulting remarks.....	Violent emotional reaction.....	When the bad right ear was closed, patient blushed.
Lombard test; Noise apparatus in good ear.....	No raising of voice.....	No raising of voice.
Stethoscope test.....	Does not cooperate.....	Correctly counts taps at 5 feet with tube to good ear closed.

Summary of cases 2, 3, 4, and 5.—Case 2 represents the normal findings in a patient who has just recovered from a simple mastoid operation. He is cooperative and truthful with all his answers. There is still some thickening and retraction of the right ear drum, although the drum is healed. Attention is invited to the remarkably good hearing in spite of the recent operation.

Case 3 represents a typical conduction deafness with positive pathological findings in both ears. He had a large polyp with profuse purulent discharge in right ear. The X ray showed a sclerosed mastoid on both sides. A modified radical mastoid operation was later done on the right side. As the left ear drum was healed, although thickened and retracted with scar, no operation was performed on this ear. This patient had the typical attitude of the

hard of hearing. He always spoke with a monotonous and loud voice. He cooperated in every respect.

Case 4 was an ignorant negro. He had a slight conduction deafness, but this was grossly exaggerated. There could not be any nerve deafness, as the cold caloric test was normal. The Weber test lateralized to the good ear, which is typical of the malingerer. He should have good bone conduction, as his labyrinth is intact. He does not raise his voice when the Lombard test is used. He should hear the coin click at about 6 feet in his left ear. When off guard, he answers questions addressed to him in the spoken voice at 20 feet. When insults are hurled at him from some distance he has a violent emotional reaction. This man is a typical malingerer, as he also tried to deceive the examiner during the eye examination. With the aid of reversed letters, a mirror, and the following correction, plus 25 S minus 25 S, which equals zero in refractive power, he reads 20/20 plus; admits vision of 20/100.

Case 5 claimed that he had a running ear while in Haiti in 1920. The right ear discharged for two weeks then. No evidence of this could be found in the drum. He also claimed that he had pain over the right mastoid. X ray was negative. This man was very alert and aroused the suspicion that he had been coached in some tests. He was also worried about his eyes and suggested that he should receive an increase of compensation on account of a minor refractive error.

In the foregoing article it has been the writer's aim to cover all eventualities that an examiner may be confronted with. One who takes up this work is surprised at the little help he gets from textbooks and literature; he is thrown on his own resources to a great extent. For this reason the new tests mentioned were devised by the writer several years ago. Cases 2 and 3 were discussed to show what results to expect in genuine pathological cases. The work involved is exceedingly exacting and very disagreeable at times. Naturally one does not make friends by exposing somebody's fraud. Sometimes one is disappointed in not being upheld by a court-martial, because the court expects one to prove that the malingerer was trying to avoid duty, in addition to showing that he has not the disability he pretends to have and that he has deceived the examiner. See definition of malingering in Webster's dictionary.

SIMULATION

By TOM A. WILLIAMS, M. D., Washington, D. C.

There is great diversity of opinion among psychiatrists regarding the psychopathic nature of simulation. There has been an ex-

cessive attempt, more particularly in France and latterly in America, to remove responsibility from simulators, more especially when these are criminals. In England, perhaps, the other extreme has been the rule, namely, to punish criminals without reference to their mental condition unless this is glaringly disordered. Again, some psychiatrists think that malingering is a sign of a feeble mental state, whereas others, with Jendrassik, insist that the malingerer is nearly always better endowed mentally than the hysteric, i. e., that in order to simulate a disease it is necessary to possess an associational system of considerable complexity, which the hysteric lacks. There are those who declare that the more experienced is the observer in the study of mental abnormalities and of the insane the less inclined is he to give a diagnosis of malingering. But with reference to this, one must remember the unfortunate tendency of alienists to find everyone abnormal and to excuse the behavior of everyone they examine on the ground of the deviation which they always find. If this doctrine were carried out to its logical conclusion, there would be an entire end to social responsibility, for no one is free from mental peculiarities.

As a matter of wise policy, however, it is all the more imperative that those whose psychological tendencies do not enable them to control themselves by motives emanating from within should be provided with strong motives from without calculated to induce them to behave themselves as decent members of society. Thus, in practice, it is the very persons who are the least responsible because they have the least power of self-control whom it is most dangerous to society to relieve of the fear of the punishment which impends when they break laws.

These considerations are just as true in the Army and Navy as they are in civil life.

At the same time it must not be forgotten that there is a degree of defective function which renders it impossible for an individual to respond to continuous stimuli from without, however powerful. Men who reach this degree of neurological deficiency must, of course, be removed from the ranks for treatment.

It is to be remembered, however, that there is a very strong temptation for a patient who is really suffering to exaggerate his symptoms if he is the least suspicious that the doctor is going to regard them too lightly. This is particularly true in cases of sciatica, neuralgia, or lumbago. This tendency of the patients makes the examiner's task sometimes very difficult, as he is in danger of falling into the mistake that the patient has nothing at all because so many of the symptoms he presents can be shown to be simulated. The best way to prevent this tendency of patients is to obtain the reputation

of honestly considering each case on its merits and to avoid the reputation of being too ready to minimize the man's complaints. Some neurologists adopt the plan of permitting other patients to witness each examination. In this way the men become impressed with a thoroughness of the doctor's examination and with the fact that he does not ignore legitimate complaints. As soon as the men understand this, they are deprived of their chief motive for exaggeration of symptoms, unless it is a case of out-and-out malingering. The case which is difficult is when exaggeration or simulation is only an addition to real symptoms.

The greatest difficulty is as regards pain complained of, for here the task becomes one of proving a negative, manifestly impossible. So that we must have recourse to inferential probability. However, most malingerers complain not only of pain, but of tenderness on pressure. It is here that they place themselves in danger of being caught, for the observer can so vary the location and nature of the pressure without the knowledge of the patient that it is generally easy to show the inconsistency of a complaint without any real affection. Furthermore, local tenderness causes inhibition of movement of the part, which remains fixed in one's attitude. The result is that there are modifications in the skin folds which can be detected upon inspection, and sometimes one can observe by X-ray modifications of the joint surface. If these tests are negative, local or general anæsthesia will show whether there are muscular or tendinous retractions. In some cases electrical stimulation will demonstrate this. In all of these cases we would infer that we are not dealing with a complete malingerer.

The most difficult situation to adjudicate is that of pain in the back whether it is from an alleged injury or simply lumbago. In the former case there should always be a point of maximum tenderness which is aggravated not only by pressure but when the patient straightens the back after stooping. In lumbago, tenderness is either absent or diffuse, and the pain is aggravated only when the patient contracts the muscles and not as a rule on passive movements of the spine by the examiner.

In complaints of loss of power, malingering is easier to detect than where pain is the issue. In this case, however, the difficulty lies in distinguishing between deliberate simulation and the affectation of incapacity on account of an honest notion gained by suggestion or imagination. It is usually easy by means of suggestion or distraction to surprise the patient into making any movements the examiner desires. The genuine hysteric will thereupon continue to perform these movements when requested; the deliberate malingerer will cease to move the part as soon as he realizes what has happened.

BLINDNESS

A genuine patient is usually detected by the consistency of his actions in relation to a nonvisual condition, but the malingerer exaggerates his attempts at vision in order to impress the observer that his case is genuine. He will gaze and stare, turn his head from side to side in order to convince the examiner that he is making every effort to see, and then declares his inability to do so. His answers to questions are clearly prepared beforehand, inconsistent, and variable. When asked to read, he moves the type backwards and forwards in front of his eye, first in one position and then in another. If told to look at his hand held in front of his face, with the pretended blind eye, he will look in the wrong direction. His general demeanor is also suspicious. He assumes a boisterous manner, bordering on the aggressive, for the benefit of the examiner. The only way to outwit cases of this type is to meet deception with deception. The surgeon must pretend to believe in the man's incapacity and show sympathy with his condition. Any display of hostility or lack of patience will greatly impede the proving of the deception.

THE CLASSIFICATION OF BACTERIA

By J. M. McCANTS, Lieutenant Commander, Medical Corps, United States Navy

Since the discovery of bacteria by Leeuwenhoek in the seventeenth century bacterial nomenclature has been in an unsatisfactory state. At first these organisms were regarded as belonging to the animal kingdom, which supposition, of course, has later been shown to be erroneous. Even now uncertainty exists as to whether certain genera are animal or vegetable, but recently certain microorganisms long considered to be protozoa have been included in the classification of bacteria. The *Treponema pallidum* is an example of this recent tendency.

The earlier classifications of bacteria were based entirely on morphology. Such a classification is fundamentally proper and is used for the higher forms of life. But bacteria, being very rudimentary forms of life, simply do not possess a sufficiently varied and discernible morphology upon which to base a comprehensive classification designed to cover the many hundreds of species now known to exist.

It was the Winslows of this country who, in 1908, made the first attempt to classify bacteria using a combination of their morphology and biological characteristics as a basis. Such a classification has advantages over previous ones and has since been modified and made more comprehensive by various bacteriologists. The more important workers using morphology as a basis for their classifications were

Lehmann and Neumann (1896), Migula (1900), and Chester (1901), while among the more outstanding systematists following the Winslows (1908) and using both morphology and biological characteristics as a basis for their classifications may be mentioned Buchanan (1915), Castellani and Chalmers (1919), and Bergey, of the present day. Buchanan in 1915 is credited with having worked out the most satisfactory and complete classification up to that time. The more recent work of Bergey and his associates, now in general use in this country, and the outcome of the Society of American Bacteriologists, is based largely upon the classification by Buchanan.

Older classifications and specific names have possessed many faults. The synonyms are numerous, and often organisms once considered to be entirely distinct species were later shown to be one and the same. The identity of *Bacillus psittacosis* and *Bacillus aertrycke* is a recent demonstration of this dilemma. When one observes such terms as typhoid bacillus, *Bacillus typhosus*, *Bacterium typhosum*, *Salmonella typhi*, or *Eberthella typhi* in reference to the etiologic agent of typhoid fever, the justification of a classification giving each specific organism a name that will remain and come into general use is at once appreciated.

In 1917 a committee, appointed by the Society of American Bacteriologists, evolved a new classification based largely upon the previous work of the Winslows, but especially upon that of Buchanan. This committee, headed by Bergey, has since made certain modifications of their original work, and have thus, with the aid of many competent bacteriologists, kept the classification up to date. Bergey's *Manual of Determinative Bacteriology*, 3d edition, 1930, is the last word on bacterial nomenclature and is the standard in this country.

It will be noted that the newer terminology has crept into the literature, that the latest books on bacteriology are following Bergey's classification, and that certain foreign authors are also using it (e. g., Topley and Wilson in their *Principles of Bacteriology and Immunity*). Likewise the *Bulletin of Hygiene*, of the Bureau of Hygiene and Tropical Diseases (London), adopted the new nomenclature about two years ago.

Bergey's classification is guided by the international rules of botany in so far as these can be made to apply to bacteriology. Hence the classification is more scientific, more comprehensive, and will have a tendency to become more universally adopted than any previous one. Also Bergey's manual is excellent for tracing down an unknown organism, and a newly described organism can be readily added to it. Hence the classification is not only scientific and comprehensive, but it is flexible and practical.

The newer names for species are for the most part descriptive of that species. The genus is often named after some person prominently associated with the discovery of the organism or like organism and always begins with a capital letter (e. g., *Eberthella typhi*). The specific name always begins with a small letter, even though, in instances, it is based on a proper noun (e. g., *Salmonella morgani*). The terms now used have the disadvantage of being somewhat cumbersome, but have the distinct advantage of being more scientific. This will doubtless please the botanist more than his medical friend who is reluctant to give up old terms with which he is so familiar. On the other hand the botanist can hardly appreciate those serologic differences within a single species which in medicine may be so important.

Be that as it may, the newer classification of bacteria is a step in the right direction and is rapidly coming into general use, even though it is admittedly imperfect and may from time to time be modified as the science of bacteriology grows, or to make the classification more universally applicable. It, therefore, behooves us to become familiar with the new guises under which old friends are now cloaked.

The following scheme will give the general classification of bacteria (class schizomycetes) now in vogue. For details and sub-classifications one is referred to the newer works on bacteriology and more especially to Bergey's Manual, which should be in all of our clinical laboratories and medical libraries.

CLASS: SCHIZOMYCETES ORDERS

I EUBACTERIALES: II ACTINOMYCETALES: III CHLAMYDOBACTERIALES: IV THIOBACTERIALES:
V MYXOBACTERIALES: VI SPIROCHETALES

ORDER	FAMILY	TRIBE	GENERA	SPECIES
Eubacteriales	I. Nitrobacteriaceæ	I. Nitrobacteriæ	8 Genera	20 Species, none pathogenic.
		II. Azobacteriæ	2 Genera	12 Species, none pathogenic.
	II. Coccaceæ	I. Streptococcaceæ	I. Diplococcus	3 Species, e. g. D. Pneumoniae.
			II. Streptococcus	35 Species, e. g. S. Pyogenes.
			III. Leuconostoc	4 Species, e. g. L. Mesenteroides.
	III. Spirillaceæ	II. Neisseriæ	I. Neisseria	N. Gonorrhoea. N. Intracellularis. N. Catarrhalis.
			II. Gaikya	2 Species, e. g. G. Tetragena.
	III. Micrococcaceæ		I. Staphylococcus	5 Species, e. g. S. Aureus.
			II. Micrococcus	41 Species, e. g. M. Cereus, M. Urea.
			III. Sarcina	11 Species, e. g. S. Ventriculi.
Eubacteriales	III. Spirillaceæ		IV. Rhodococcus	6 Species, e. g. R. Rosaceus.
			I. Vibrio	20 Species, e. g. V. Comma.
			II. Spirillum	5 Species, e. g. S. Undula.
	I. Chromobacteriæ		I. Serratia	27 Species, e. g. S. Marcescens.
			II. Flavobacterium	67 Species, e. g. F. Aquatilis.
			III. Chromobacterium	10 Species, e. g. C. Violaceum.
	II. Protomonobacteriæ		IV. Pseudomonas	31 Species, e. g. P. Aeruginosa.
			I. Protomonobacter	5 Species, e. g. P. Alabastrum.
			I. Cellulomonas	33 Species, e. g. C. Blazotea.
	IV. Achromobacteriæ		I. Achromobacter	84 Species, e. g. A. Liquefaciens.
Eubacteriales	IV. Bacteriaceæ		I. Erwinia	12 Species, e. g. E. Amylovora.
			II. Phytomonas	81 Species, e. g. P. Campestris.
			I. Lactobacillus	35 Species, e. g. L. Acidophilus.
	V. Erwinieæ		I. Propionibacterium	8 Species, e. g. P. Freudenreichii.
			I. Kurthia	2 Species, e. g. K. Zengeri.
			I. Pasteurella	6 Species, e. g. P. Pestis.
	XII. Bacteraceæ		I. Klebsiella	6 Species, e. g. K. Pneumoniae.
			I. Hemophilus	8 Species, e. g. H. Influenzae.
			II. Dialister	1 Species, e. g. D. Pneumosintes.
Eubacteriales	XIII. Bacteroides		I. Escherichia	29 Species, e. g. E. Coli.
			II. Aerobacter	6 Species, e. g. A. Aerogenes.
			III. Proteus	7 Species, e. g. P. Vulgaris.
	XIII. Bacteroides		IV. Salmonella	20 Species, e. g. S. Enteritidis.
			V. Eberthella	11 Species, e. g. E. Typhi.
			VII. Shigella	13 Species, e. g. S. Dysenteriae.
	V. Bacillaceæ		VII. Alkaligenes	10 Species, e. g. A. Fecalis.
			I. Bacteroides	19 Species, e. g. B. Fragilis.
			I. Bacillus	93 Species, e. g. B. Anthracis.
			II. Clostridium	50 Species, e. g. C. Welchii.

CLASS: SCHIZOMYCETES ORDERS—Continued.

FURTHER SUBDIVISIONS

ORDER	FAMILY	TRIBE	GENERA	SPECIES
II. Actinomycetales	{ I. Actinomycetaceæ	{	I. Actinobacillus	1 Species, e. g. A. Ligneresi.
			II. Leptorichia	2 Species, e. g. L. Bucallis.
			III. Actinomycetes	70 Species, e. g. A. Hominis.
			IV. Erysipelothrix	2 Species, e. g. E. Rhusiopathiae.
III. Chlamydobacteriales	{ II. Mycobacteriaceæ	{	I. Mycobacterium	19 Species, e. g. M. Tuberculosis (Hominis).
			II. Corynebacterium	17 Species, e. g. C. Diphtheriae.
			III. Fusiformis	4 Species, e. g. F. Dentium.
			IV. Pleistiferella	1 Species, e. g. P. Mallei.
IV. Thiobacteriales	{ I. Chlamydobacteriaceæ	{	5 Genera	9 Species, none pathogenic. (Iron and swamp-water bacteria.)
			I. Rhodobacteriaceæ	
			II. Beggiatoaceæ	
			III. Achromatiales	
V. Myxobacteriales	{ I. Myxobacteriaceæ	{	32 Genera	62 Species, none pathogenic.
			Bacteria containing sulphur granules and/or bacteriopurin.	
			3 Genera	21 Species, none pathogenic.
			Forming plasmodium like masses in dung and upon decaying vegetable matter.	
VI. Spirochaetales	{ I. Spirochaetaceæ	{	I. Spirochaeta	5 Species, e. g. S. Plicatilis.
			II. Saprospira	2 Species, e. g. S. Grandis.
			III. Cristispira	8 Species, e. g. C. Baibianii.
			IV. Borrelia	15 Species, e. g. B. Recurrentis.
			V. Treponema	8 Species, e. g. T. Pallidum.
			VI. Leptospira	4 Species, e. g. L. Icterohæmorrhagiae.

THE NAVAL AMMUNITION DEPOT, HAWTHORNE, NEV.

By D. B. PETERS, Lieutenant, Medical Corps, United States Navy

An account of the new station at Hawthorne may be of interest to medical officers because it is still little known, and as it has several unique features it might appeal to many medical officers as a possible future billet.

It is situated on the southern end of Walker Lake and is about 2 miles northwest of the town of Hawthorne, which has a population of six or seven hundred.

The magazine area, embracing 10 square miles, is situated on a broad unobstructed plain $3\frac{1}{2}$ miles east from the industrial area. The industrial area, known as the naval ammunition depot, embraces practically all classes of construction encountered in building a small city, including railroad tracks that connect with Thorne, the nearest railroad station, located about 6 miles from the industrial area.

The buildings are of brick construction and reinforced concrete. The gross land area of the Government reservation comprises approximately 197 square miles. The natural advantage is geographical, the situation being in the center of the western portion of the United States, approximately east from San Francisco, from which it is separated by the Sierra Nevada Mountains, and an equal distance from Seattle and San Diego.

The reservation embraces a barren desert region, with an annual rainfall of about 3 inches, and is over 4,000 feet above sea level. The most important feature in the construction of the depot was to secure an adequate supply of fresh water. The water of Walker Lake, which contains too large an amount of soluble salts, was unsuitable for human consumption.

The development of the Rose Creek supply was decided on. At an elevation of 5,572 feet a cut-off wall (upper intake) was constructed across the stream, which collected the water which is now passed for a distance of 2,000 feet through a 4-inch pipe down the mountain side with a drop of about 350 feet to a lower intake and then to the sedimentation basin, which is constructed of concrete capable of a capacity of 3,000 gallons. This chamber is provided with a spillway to take care of flood flows, necessary valves, and drains to permit flushing and cleaning.

From this lower intake (sedimentation pool) the water passes through a 6-inch pipe to the distribution reservoir; this line has gate valves at intervals of 3,000 feet and was run close to the foothills with a view of maintaining low pressure in the line of approximately 450 pounds per square inch. The source of water supply is about 7 miles from the depot.

The reservoir is built of reinforced concrete and is octagonal in shape, with a capacity of 600,000 gallons. The roof is of flat concrete construction and this is covered with a foot of earth. The reservoir is separated into two sections by a partition wall to permit cleaning one section and yet having a supply of water for use. Each section has separate supply, service, drainage, and overflow lines.

The following governed the location of the distribution reservoir:

(a) The elevation was sufficient to maintain adequate pressure in the industrial and personnel area.

(b) The location was relatively free from possible contamination.

An 8-inch pipe runs from the reservoir to the industrial area, a distance of 7,500 feet, and from this point is distributed to the various buildings.

SEWERAGE SYSTEM

The gravity system is in use. The septic tanks are provided with two compartments, so one can be cleaned without interfering with the system. The disposal field has proven satisfactory.

GARBAGE DISPOSAL

A very complete incinerator is connected with the power house, where all garbage is disposed of by burning.

RECREATION FACILITIES

Provisions for suitable facilities for recreation was recognized as important from the viewpoint of health and contentment of the personnel. The proximity of Walker Lake affords recreation in the form of swimming. Bathhouses and diving boards have been erected.

Walker Lake is 2 miles from the depot and is one of the largest salt lakes in the State. It is about 25 miles long and from 2 to 5 miles wide and has no outlet. It is fed by Walker River on the north end and by numerous small creeks of transient flow on the eastern slope of the Wassuk Range and is 4,044 feet above sea level.

A 9-hole golf course, tennis courts, and baseball diamond have been provided, and a recreation building for movies and dances has also been provided.

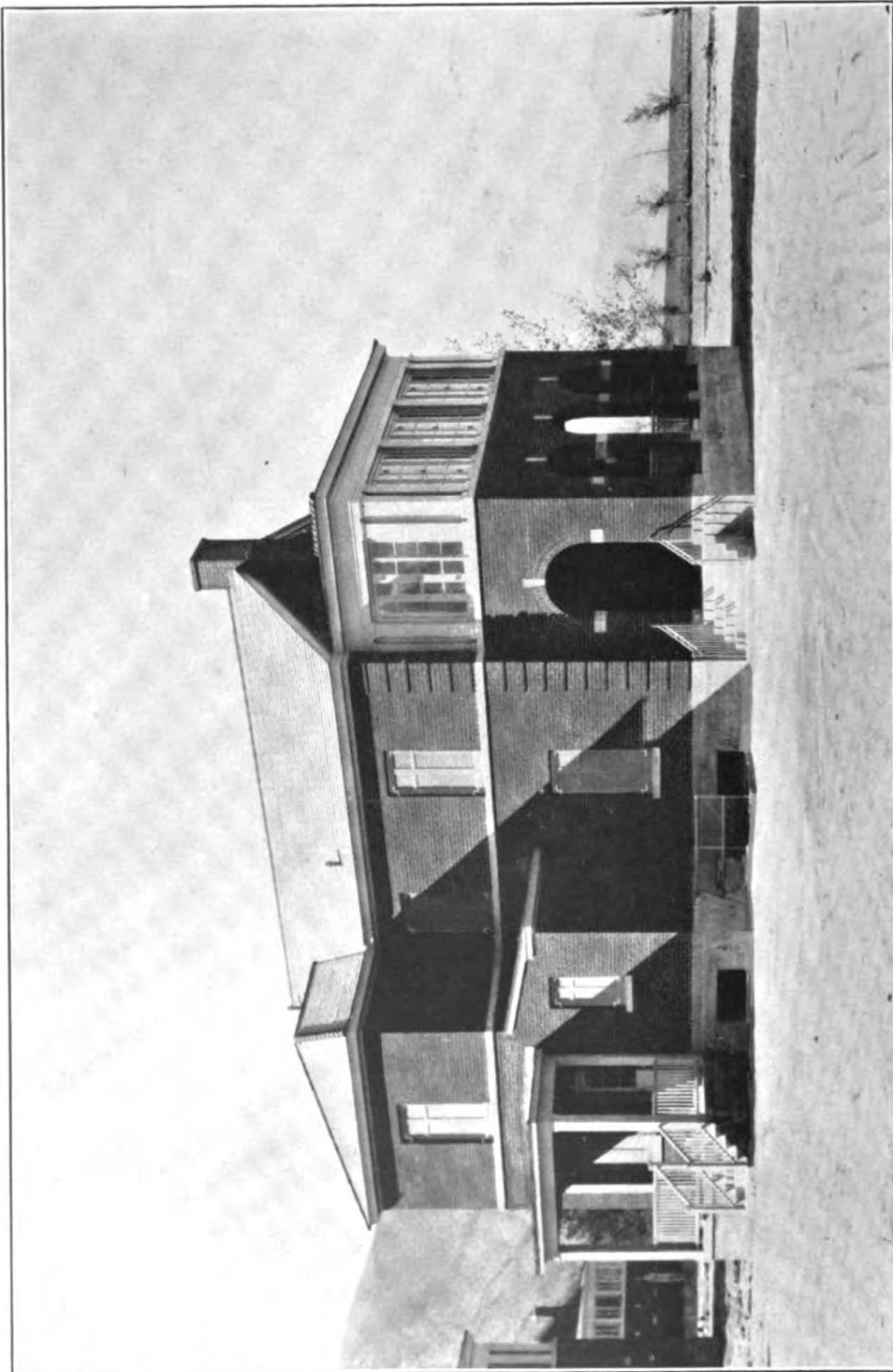
FACILITIES FOR THE CARE OF THE SICK

The dispensary is located in the center of the industrial area and is conveniently arranged for the care and treatment of the sick. The building contains the following rooms:

Basement: three storerooms, X-ray room, X-ray developing room, X-ray viewing room, and cleaning-gear room.



DISPENSARY BUILDING, NAVAL AMMUNITION DEPOT, HAWTHORNE, NEV.



MEDICAL OFFICER'S QUARTERS, NAVAL AMMUNITION DEPOT, HAWTHORNE, NEV.

First or main floor: main operating room, dressing room, dispensary, two office rooms, and hospital corpsmen's quarters.

Second floor: two quiet rooms with private bath and toilet, a 5-bed ward, nurses' office, and diet kitchen. The equipment is modern and complete in every respect.

Living quarters, consisting of two bedrooms, living room, kitchen, dining alcove, and bath is also provided for the chief pharmacist's mate on the second floor, west end.

All quarters are equipped with electric ranges and Frigidaires. Heat is furnished by the power house.

CLINICAL NOTES

DERMATITIS EXFOLIATIVA FOLLOWING NEOSALVARSAN

A DISCUSSION AND A CASE REPORT

By A. C. SURBER, Jr., Lieutenant (Junior Grade), Medical Corps, United States Navy

It is significant that, following an exhaustive review of the records of all cases of poisoning by an arsphenamine by a board of medical officers, the Surgeon General of the Navy recently issued a circular letter (1) devoted to the subject of preventing untoward reactions in the administration of the arsphenamine.

Dermatitis exfoliativa, characterized by a local or generalized desquamation of the skin without atrophy (2), is severe enough and occurs with sufficient frequency, according to the British Medical Research Council, to be grouped with encephalitis hemorrhagica and acute yellow atrophy of the liver as one of the most important ill effects of treatment with arsenobenzol preparations which may end fatally.

In an excellent statistical résumé of the 272,354 injections of arsenical compounds administered in the United States Navy during the period 1925 to 1928, inclusive, Phelps and Washburn (3) found a total of 4 fatal cases and 16 severe nonfatal cases of exfoliative dermatoses.

Kraetzer (4) has made some interesting and stimulating suggestions as to the sources of arsenical retention aside from medicinal administration. Arsenic has been found in food, drink, wearing apparel, and decorative pigments. The enormous use of arsenical insecticides makes fruits and vegetables a potent source of poisoning. Cotton, wool, and silk may be contaminated and shellfish and cocoa may contain it.

In regard to the palliation and control of arsphenamine reactions, Stokes (5) has insisted upon the small initial dose and, in late cases particularly, the preparation of the patient with mercury before arsenic is begun. More recently in a highly pertinent and stimulating paper (6) he suggests ephedrin in 50-milligram doses for two days before an injection and the utilization of the detoxifying and irritation-reducing effect of calcium gluconate intravenously or intramuscularly in 10 c. c. doses before injection.

The active treatment of the metallic intoxications received a tremendous stimulus in 1926 with the appearance of the important paper of Marples and Myers (7) on the action of sodium thio-sulphate. That its proper administration is far more than a matter of massive dosage has become increasingly apparent. In their communication on acute arsenic poisoning in 1929, Althausen and Gunther (8) noted the increased excretion and storage of arsenic in the appendages of the skin (hair and nails) consequent to sodium thio-sulphate treatment. Kraetzer (4) has commented on the ebb and flow of arsenic excretion during thiosulphate administration and has remarked on the cessation of improvement or even exacerbation of symptoms during treatment. Certainly the action of thiosulphate is not a neutralization, but a liberation of tissue-fixed arsenic by a process of oxidation with subsequent excretion, notably by the liver, the skin, and its appendages, the amount excreted depending upon the dynamic ability of the cells to rid themselves of the metal. There is a possible spirochaeticidal effect. Walker and Flower (9) in a highly interesting and suggestive paper, have recently reviewed the entire question of thiosulphate therapy, and in connection with its pharmacology in Kahn-fast cases suggest that in addition to releasing the fixed arsenic from the tissues of the host, the metal in the arsenic-fast treponemata is also set free, again rendering them susceptible to the action of the liberated arsenic. In a splendid report of eight cases they note the effects of too-rapid oxidation of the retained arsenic and cite particularly the exacerbation of an arsenical dermatitis due to an inability to excrete the excess of liberated arsenic. They comment on Kimbrough's communication (10) and in common with him report encouraging results with Kahn-fast patients.

The following case presents a number of interesting problems:

CASE REPORT

R. F. H., seaman first class, United States Navy, age 22, contracted syphilis in Hong Kong, China, April 5, 1930, an original infection. Diagnosis was established that date by positive dark-field examination of the primary lesion. There had been no previous treatment with an arsenical compound.

Routine treatment was instituted consisting of mercury inunctions twice a week and weekly intravenous injections of neosalvarsan as follows:

	Date	Amount		Date	Amount
		<i>Grams</i>			<i>Grams</i>
Dose 1.....	Apr. 8, 1930	0.3	Dose 6.....	May 13, 1930	0.60
Dose 2.....	Apr. 15, 1930	.3	Dose 7.....	May 21, 1930	.60
Dose 3.....	Apr. 22, 1930	.45			
Dose 4.....	Apr. 30, 1930	.60	Total.....		3.45
Dose 5.....	May 6, 1930	.60			

Carefully repeated tests were made on the three and six hour urine specimens after each injection and showed apparently excellent arsenic elimination. Kahn test May 25, 1930, showed four plus.

On May 26, 1930, the patient was admitted to the sick list, complaining of general malaise, sore throat, cough, headache, aching of muscles, and a temperature of 102°. He improved rapidly under bed rest, forced fluids, and salicylates. Urinalysis showed a very slight trace of albumin. Mosenthal test showed excellent kidney function. The skin showed a rapidly fading macular syphilid.

On June 8, 1930, the macular exanthem became dusky red. On June 10, 1930, an acute, weeping, dusky-red, maculo-papular eruption appeared over the flexor surfaces of the extremities, with slight oedema of the ankles, and temperature of 101. These weeping areas soon crusted over and exfoliation followed. The bowels and kidneys functioned normally; appetite was excellent. In spite of extreme discomfort the patient was not alarmingly ill. Urinalysis showed a few red cells, slight trace of albumin, occasional granular casts. White blood count was 8,600. (A moderate leucocytosis rather than a leucopenia characterized this case.)

As noted above the last dose of arsenical was administered May 21, 1930. The malaise, etc., of May 26 might have been prodromal, but no definite exanthem was noted until June 8—an unusual delayed reaction of 18 days following the last (seventh) injection.

This final dose of Neosalvarsan consisted of 0.6 grams diluted in 20 c. c. of distilled water, and very slowly injected.

Treatment: Bed rest, soft diet, immediate discontinuance of antisyphilitic therapy, saline catharsis; petrolatum to the crusting areas.

Sodium thiosulphate, grams 1 intravenously daily at 9 a. m.; also grams 1 by mouth t. i. d. p. c. On June 18, due to exacerbation, dosage reduced permanently to 1 gram intravenously at 9 a. m. and 1 gram orally at 4 p. m.

By June 15 the eruption had partially cleared, but on June 18 an acute exacerbation of the eruption occurred on the flexor surfaces of the extremities, the face, and behind the ears. On June 20 a small superficial abscess behind the right ear was incised and drained. By June 21 desquamation of the epidermis of the face, arms, legs, hands, and feet was very marked. By June 25 there was definite subsidence of acute symptoms without further recurrence. There was pronounced loss of hair. Urinalysis showed a few red cells and a faint trace of albumin. White blood count, 7,500.

By July 9, the skin was practically normal except for slight weeping and exfoliation in the popliteal and antecubital fossæ and behind the ears. Kahn test, July 13 showed four plus.

Recovery was uneventful until July 14, when a slight transient icterus appeared with moderate nausea, itching of the skin, and tinging of the conjunctivæ. There was no hepatic enlargement, tenderness or pain.

The patient returned to duty July 24, after 38 sick days.

DISCUSSION

There are several noteworthy features in connection with this case.

1. A young man with a primary and original infection, during his first course of treatment, without any premonitory signs of idiosyncrasy (table reactions, etc.), and in spite of apparent excellent excretion, develops a severe dermatitis.

2. There is an unusual delay of 18 days following his last injection before the appearance of the exanthem. If the symptoms supervening on May 26 are to be considered prodromal, there is still an unusual delay of five days since the final injection.

3. An accute exacerbation of the eruption occurred during treatment with large doses of thiosulphate; clearing on reduction of dosage is probably explained by the release of an amount of arsenic not commensurate with the patient's powers of excretion (4) (8).

4. A moderate leucocytosis rather than a leucopenia characterized this case throughout, probably indicating no appreciable bone-marrow damage.

5. There is a pronounced loss of hair, an undoubted indication of excretion and storage in the skin and appendages (8).

6. A mild transient jaundice appeared late in the convalescence unattended by hepatic enlargement, tenderness, or pain; and without previous evidence of a latent jaundice (1).

It is undoubtedly true that in the administration of arsenicals there is a splendid opportunity to practice preventive medicine in its most practical sense. The fundamentals of a sound procedure are inherent in the basic and pertinent rules of: Small initial dosage; a moderate maximum dosage; preparation of the patient; balance of intake and elimination; and the early recognition of a latent jaundice (1) (5) (6). In the last analysis, proper antisymphilitic therapy is based upon the proper management of the individual tolerance.

SUMMARY

1. Dermatitis exfoliativa is one of the important manifestations of arsenical poisoning. .

2. The dosage of sodium thiosulphate should be correlated with the patient's ability to excrete the free arsenic.

3. Sodium thiosulphate is apparently of value in Kahn-fast cases.

4. A case of severe dermatitis exfoliativa appearing 18 days following the seventh dose of Neosalvarsan is presented, showing an exacerbation of symptoms during thiosulphate treatment, and a late-transient jaundice, with complete recovery.

5. The proper use of ephedrin, calcium, and mercury preparations; small initial and moderate maximum dosage of arsenicals; balance of intake and elimination; and the early recognition of a latent jaundice will tend to prevent reactions.

BIBLIOGRAPHY

(1) Bureau of Medicine and Surgery, Circular letter No. 492, 1929. (October 25, 1929.)

(2) Hazen, H. H.: Diseases of the Skin (Mosby), 1927, p. 432.

(3) Phelps, J. R., and Washburn, W. A.: Toxic Effects of Arsenical Compounds Employed in the Treatment of Syphilis in the United States Navy. Naval Medical Bulletin, July, 1930, p. 659.

(4) Kraetzer, A. F.: Raynaud's Disease Associated with Chronic Arsenical Retention. J. A. M. A., 94:1035, April 5, 1930.

(5) Stokes, J. H.: Modern Clinical Syphilology.

(6) Stokes, J. H.: Critical Treatment Problems in to-day's Syphilology. J. A. M. A., 94:1029, April 5, 1930.

(7) Marples, E., and Myers, C. N.: The Action of Sodium Thiosulphate in the Treatment of Metallic Intoxications and Lesions of the Skin. Proc. Soc. Exper. Biol. and Med. 24:39-43, 1926.

(8) Althausen, J. L., and Gunther, L.: Acute Arsenic Poisoning. J. A. M. A., 92:2002, June 15, 1929.

(9) Walker, A. T., and Flower, C. F.: Sodium Thiosulphate in the Treatment of Syphilis. Naval Medical Bulletin, July, 1930, p. 569.

(10) Kimbrough, J. W.: Naval Medical Bulletin, April, 1928, p. 344.

GRANULOMA INGUINALE—CASE REPORT

By G. C. THOMAS, Commander, Medical Corps, United States Navy, and J. W. KIMBROUGH, Lieutenant (Junior Grade), Medical Corps, United States Navy

Chancre and chancroid are not infrequently contracted as the result of a single exposure, and occasionally to this double infection is added the further insult of a gonococcus infection of the urethra. When the above-mentioned triple infection is further complicated by granuloma inguinale it might be considered as adding something more than insult to injury.

A case presenting all four of these conditions is reported here owing to the comparative rarity of granuloma inguinale in the naval service.

Granuloma inguinale is a noninflammatory venereal disease involving the genitalia and surrounding skin area.

The disease has been present in the more torrid countries for many years, but has been described as a distinct entity only during the past decade. More recently its presence has been noted within the United States. Also it is found in South America and Australia.

This disease is found more frequently in the colored than in the white race. Males are more often affected than females.

Infection is supposed to take place by means of direct contact with an infected individual, but this has not been definitely proven.

Donovan, in 1905, described the organism which is now generally regarded as specific, but this is not always demonstrable.

It is a Gram negative, nonspore-bearing, nonmotile, encapsulated bacillus found in thin smears made from the ulcerated area after the surface exudate has been removed. The Wright, or Giemsa, method of staining is used.

The organisms appear as small, rounded, pinkish bodies with a dark blue coccoid body in the center. The pinkish outline is due to the presence of a wide capsule and this must be decolorized to obtain the true outline of the body proper. These organisms are found in the cytoplasm of large mononuclear cells. At times they are said to appear in nests, without capsules, and presenting a bipolar stain. Nonencapsulated forms occur in the polymorphonuclear cells.

Secondary organisms are few as compared with other genital ulcers.

The organisms do not liquefy gelatin or coagulate serum.

Blood is hemolyzed by freshly isolated cultures. Milk is coagulated and acidified. Indol is not produced. All the common sugars are fermented, but dulcitol and rice starch are not. The organisms grow luxuriously on all ordinary culture media and are favored by an acid reaction. The colonies are from 1 to 3 mm. in diameter and are grayish-white, translucent, dome-shaped elevations.

Pathologically the lesion is characterized by dense fibrous connective tissue with an infiltration of endothelial leukocytes. Many blood vessels are present. Extending beyond the apparently normal skin edge is a subcutaneous round cell infiltration. Near the edges of the granuloma the proliferation of squamous epithelium causes finger-like projections extending into the deeper tissue and at times suggestive of squamous-cell carcinoma.

The initial lesion is a small papule, which ruptures with the exudation of slightly purulent fluid. This lesion refuses to heal, spreads slowly with a resultant overgrowth of reddish-pink granulation tissue. Unlike an ulcer the edges are redundant and overlap the apparently healthy skin margin. The scanty, mucoid exudate is practically odorless.

Some of the older lesions show a tendency to cicatrization in some areas, while spreading in others.

The lesions are painless aside from pressure due to clothing.

The groin is the most frequent location, spreading occurring in all directions. The penis may be extensively eroded.

In the female the labia majora are the most acutely affected.

Secondary anemia is generally present.

There are no characteristic blood changes.

Diagnosis is based on (1) the clinical picture, (2) demonstration of the specific organism, and (3) therapeutic result from the intravenous use of antimony.

Infections to be differentiated are chancroid, tertiary syphilis, and tuberculosis.

A sore occurring in the groin, perineum, or genital region, which is resistant to ordinary antiseptics or intravenous arsphenamine, should be examined for the specific organism of granuloma inguinale.

The prognosis is good under antimony therapy. No other form of treatment is effective.

Antimony is given in the form of tartar emetic. A one per cent solution in normal saline is used and this is given intravenously daily or less frequently.

The initial dose is 4 c. c. (0.04 gm.) and this is progressively advanced until a maximum dosage of 10 c. c. (0.10 gm.) is reached. This is repeated as indicated, the guides being the response to treatment and signs of intolerance. The latter is indicated by rheumatoid pains and stiffness about the joints.

The usual precautions tending to prevent reaction are taken as with any other intravenous medication.

On the morning of July 9, 1930, an enlisted man came to sick call complaining of a sore penis. Examination revealed a tremendously swollen penis, the under surface of which was covered by many confluent ulcers. The scrotum and left thigh were also the seat of ulcerated areas. Marked phimosis was present and prevented an examination of the glans. The patient told many conflicting stories, and had apparently been concealing his condition as long as this was practicable. His reporting was probably hastened a day or so by a routine venereal inspection which was being conducted. As nearly as could be determined his infection was contracted at Ponce, P. R., on April 12, 1930. On this date he had taken the venereal prophylaxis consisting of calomel ointment and protargol.

Examination of the lesions showed them to vary from the size of a pea to that of a 25-cent piece. There was a brawny induration of the surrounding parts. As nearly as could be determined there were 15 ulcers on the penis, 5 on the scrotum, and 1 on the left thigh. These were on contiguous skin surfaces. The bases were composed of red granulations; the edges were undermined and eroded. A sero-purulent discharge was present. The ulcers were somewhat painful, but not extremely so.

Several smears from these lesions demonstrated beautifully not only numerous Donovan bodies, but also an occasional bacillus of Ducre. Repeated darkfield examinations were negative for *Treponema pallidum*.

Under local anesthesia the phimosis was reduced and the glans and under surface of the foreskin found to be free of any ulcerated areas. However, a purulent urethral discharge was present, a smear from which was heavily positive for Gram-negative intracellular and extracellular diplococci. Six days later we secured a four plus Kahn reaction from the patient's blood, thus giving us positive evidence that we were dealing with four different venereal infections, namely: Granuloma inguinale, chancroid, gonorrhea, and syphilis.

The patient was placed in bed and isolated. Continuous wet dressings of 1:10,000 potassium permanganate solution were applied to the ulcerated area. Fluids were forced and 30 grains of sodium bromide given three times daily. Dressings were changed and parts washed with soap and water twice daily. On admission the temperature was 99.4°.

On July 10 patient was given intravenously 4 c. c. of a 1 per cent solution of tartar emetic in normal saline. This was repeated, increasing the dose by 1 c. c. each time, on the 11th, 13th, and 14th.

By this time the discharge from the ulcers had greatly decreased; they were of a more healthy appearance, and numerous small epithelial islands were to be seen over the granulations.

The blood Kahn was four plus on July 15.

On July 16, 8 c. c. of tartar emetic were given. Pain and discomfort had now practically disappeared, and the objective symptoms were most strikingly improved. Practically no discharge was to be seen about the ulcers, all of which were greatly reduced in size. In fact, definite improvement could be noted between the morning and evening dressings.

Patient received 9 c. c. tartar emetic on July 18, and the following day the first symptom of overaction of the drug, with the appearance of rheumatoid pains in the area around the left shoulder and elbow, was noted.

At this stage occurred a rather interesting phenomenon when the previously copious and untreated urethral discharge ceased spontaneously and was absent for a week. Later this recurred in a less profuse form, but nevertheless the gonorrheal infection ran a remarkably mild course, as will be subsequently noted.

On July 20 some joint pains (worse in the morning) were still present, but these had cleared up four days later, and the patient was given 10 c. c. tartar emetic on the 24th. The following day the joint pains were again noted.

All lesions were now healed, and on July 31 antiluetic treatment was begun with 0.3 gm. neosalvarsan, following the injection of which there was a slight secondary rash. The patient also received 5 grains of potassium iodide three times daily and biweekly inunctions of 1 dram of mercurial ointment.

Urethral injections of 1 per cent protargol were begun on August 6, and the following day all signs of gonorrhea had disappeared.

On August 8 the patient was sent to duty under treatment for syphilis and gonorrhea. There was no reappearance of the urethral discharge at any time. It is impossible to say whether or not this extremely mild course was influenced by the tartar emetic, but the latter had no effect on the Kahn reaction, which remained four plus until antiluetic therapy was begun.

The patient's temperature ranged between normal and 100° during his illness. At time of discharge his general condition was greatly improved, and he had gained 9 pounds in weight.

HYPERNEPHROMA

By M. J. ASTON, Lieutenant Commander, Medical Corps, United States Navy

When a classification of malignant tumors of the kidney is made, the type of tumor occurring most frequently is found to be the so-called hypernephroma, first described by Grawitz in 1883. This observer considered that these tumors were similar in structure to the suprarenal gland and originated from suprarenal rests. This belief has been contested during later years by numerous competent pathologists, who advance the theory that these tumors are nephrogenic in origin.

Young and others suggest that the term "nephroma" would be more satisfactory in describing tumors originating in the kidney.

Many clinicians believe that hypernephromas are in reality carcinomas.

In a series of 500 post-mortem examinations, Hefke found suprarenal rests in only 8 cases. These occurred mostly in the upper part of the right kidney. Tumors of the renal cortex are generally considered to be carcinomas, and these, according to Braasch and Foulds, can be divided and demonstrated to be of two types, namely, adenocarcinoma and alveolar carcinoma. Hypernephromas are considered to be adenocarcinomas and present more marked differences in cellular formations than do alveolar carcinomas. The tumors which are adenocarcinoma in type are considered to possess a lesser degree of malignancy than those which are alveolar carcinomas. This latter type of tumor grows more rapidly than those tumors which are termed hypernephromas.

An interesting type of renal tumor is the embryoma of Wilms. This tumor is confined to children usually under the age of 10 years. It was originally thought to be sarcoma, adenocarcinoma, or mixed tumor, but now it is believed that carcinomatous elements predominate.

In differentiation of the types of tumors, the employment of the pyelogram is very valuable. The retraction of the renal calices showing the well known spider-leg deformity is characteristic of hypernephroma, whereas in alveolar carcinoma, the encroachment upon the renal pelvis is apt to be more marked.

From the standpoint of pathology, it is considered that hypernephromas are soft, often spherical or ovoid in shape, and yellowish or gray in appearance. Often they are hemorrhagic. Many large

tortuous superficial veins are noted on the tumor surface, lending an additional hazard to nephrectomy, if they be traumatised during operation.

From a review of 367 cases of carcinoma of the kidney seen at the Mayo clinic by Judd and Hand, it is considered that 80 per cent of all tumors of the kidney are hypernephromas. These carcinomas frequently invade surrounding structures, including veins and lymphatics. The renal vein is often involved. Metastasis occurs in 25 per cent or more of all cases. A cut section of these tumors shows numerous round or ovoid areas, yellowish gray in appearance and lipid in character. Areas of hemorrhage are frequently noted. The tumors are often necrotic and tear easily.

Microscopically, the tumor cell, which is characteristic of hypernephroma, is a large columnar-shaped cell with lightly staining body.

SYMPTOMS AND SIGNS

Renal tumors are characterized mainly by the symptoms of hematuria and pain and the appearance of the tumor mass. The usual and general symptoms of cancer, namely, weakness, anemia, cachexia, etc., are often present. Hematuria may occur early and is often the first symptom of the disease. It is usually spontaneous, profuse, and painless, and is not particularly influenced by rest, exertion, or posture. Not uncommonly, patients state that the appearance of the tumor mass was the first sign noted by them.

The degree and character of pain varies and often suggests the pain of renal colic. It is most frequently felt over the kidney region.

A very large varicocele of the left side is often present. This is due to compression of the left spermatic vein. Occasionally bits of the tumor mass are thrown out in the urine.

The renal-function test may possibly indicate renal impairment.

These tumors are very often subject to rapid growth and frequently double in size in a very few weeks. They may or may not be freely movable. The tumors of greater size and of greater fixation result in a higher mortality, either immediate or remote. In these tumors metastasis commonly occurs, although there are many cases in which metastatic involvement has not been shown. The lung is most frequently involved. Metastases to the liver, bones, and brain are also noted.

DIAGNOSTIC FEATURES

The use of the pyelogram is most important in the early diagnosis of renal tumors. The characteristic filling defects, irregularity of the pelvic outline, and retraction or elongation of the calices are fre-

quently noted. Very often the ureter is retracted to an abnormal position. A flat Röntgenogram often suggests the size of the tumor mass.

Renal function tests are commonly employed with varied results.

In differential diagnosis, one commonly considers renal tuberculosis, nephrolithiasis, polycystic kidney, and solitary cyst of the kidney. Echinococcus cyst of the kidney is rarely encountered.

In renal tuberculosis the significant features of this disease are very often in evidence. Urinary frequency with hematuria and dysuria is usually present. The acid-fast organism may be demonstrated in the centrifuged urine, and the guinea pig inoculation may be positive. Here again the pyelogram is a valuable diagnostic procedure.

Nephrolithiasis presents its own peculiar findings and symptoms. A history of renal colic and a Röntgenogram may reveal the presence of calculi in the kidney.

Polycystic disease of the kidney is always congenital and always bilateral. Palpation of these two kidneys will reveal definite irregularities and knobs, some of which are actually fluctuant. The blood urea is definitely raised, and the urea output in the urine is markedly diminished. This disease has a very interesting familial tendency.

Solitary cysts of the kidney are diagnosed chiefly by the pyelogram. In this, the outline of the renal pelvis is decidedly ovoid.

Echinococcus cyst of the kidney is of very infrequent occurrence. A flat Röntgenogram here may show a calcified outline of the mother and daughter cysts.

TREATMENT

Palliative and surgical measures are employed, depending upon the evident degree of malignancy, and the expectancy of cure or prolongation of life.

When the tumor mass is very large, with a considerable degree of fixation and metastatic involvement, operation is contraindicated.

With cases suitable for operation, nephrectomy by the lumbar extraperitoneal route, or the transperitoneal route is employed. The lumbar route yields the less mortality, but when the tumor mass is very large, many operators prefer the transperitoneal type of operation. Young advises the preliminary ligation of the veins.

A résumé of four cases of renal tumor studies at the League Island Hospital during the last eight months is given. In these cases certain well-understood facts concerning renal carcinomas are reemphasized. All of these cases but one were seen quite late in the course of the disease. The tumor masses in these cases were very large, two extending well down to the brim of the pelvis. Metastasis was not demonstrated in any case. In these cases, the tumor masses were

freely movable. Weight loss was moderate, accompanied by a moderate degree of anemia. Pyelograms showed deformities of the renal pelves and calices.

One of the cases presented a particular point of interest in relation to tumor growth. This patient entered the hospital complaining of hematuria and slight weight loss. Hematuria soon ceased and the patient insisted on leaving the hospital as he felt perfectly well. No time for satisfactory study of this case was afforded, but there was no palpable mass in the abdomen nor in the region of either kidney.

One month later the patient reentered the hospital. At this time a large, smooth, freely movable ovoid mass about 25 cm. long and 15 cm. wide was discovered in the right abdomen. This was a nephroma, and, considering its extremely rapid growth, it was believed to be the alveolar carcinoma type.

All of these cases came to operation. The patients themselves understanding the possible fatal outcome of the operation, elected to assume their individual risks, notwithstanding the slight hope of cure that was offered to them.

Considering that these tumors were all very large, the transperitoneal route was selected. No unusual operative difficulties were encountered. These cases all died. The cause of death was probably shock. Carcinomas were demonstrated by tissue study in all of our cases which came to operation.

A larger series of cases seen earlier with smaller tumor growth, in which the less hazardous lumbar extraperitoneal route could be employed, would probably yield more favorable and encouraging results.

HYPERPLASTIC TUBERCULOSIS OF CÆCUM SIMULATING APPENDICEAL ABSCESS

By J. J. A. McMULLIN, Commander, Medical Corps, United States Navy

During the year 1926 at the United States naval hospital, League Island, Pa., two patients were admitted with the diagnosis of appendiceal abscess, presenting the usual signs and symptoms—a painful and tender mass in the right lower quadrant of the abdomen, muscular rigidity, leucocytosis, and moderate fever. It was noted that the abdomen was scaphoid in both our cases and that there was no edema of the skin such as is sometimes found in appendiceal abscess. Exploration in both instances showed a tuberculous tumor of the caput coli and ascending colon, the wall of the intestine being greatly thickened, with considerable narrowing of the lumen, and marked glandular involvement of the mesentery of the affected intestinal segment.

The pathologist's report in both cases was practically identical and corroborated the diagnosis of tuberculosis: "Specimen of terminal ileum, cæcum and colon, two feet long. There was partial stenosis of the bowel, undermined transverse ulceration, and sections showed numerous distended goblet cells. Giant cells were in evidence. The submucous vessels were greatly enlarged and thickened, indicating an acute exacerbation of a chronic condition. There were also pronounced fibrosis and eosinophilic infiltration. This latter is indicative of repair. Necrosis of lymph follicles observed. Muscularis greatly thickened in parts; greater part shows hyalinization and substitution of connective tissue. Diagnosis: Tuberculosis of cæcum-hypertrophic type."

These patients are generally admitted as surgical emergencies, and to the surgeon there seems to be no better or quicker way to establish the diagnosis than to visualize the pathology by exploration. If an appendiceal abscess be found drainage can be established, and if free and accessible, the appendix can be removed; if confronted with a tuberculoma, intestinal resection should be done, provided pulmonary involvement be not advanced too far. If these patients are carefully studied, a diagnosis frequently can be made, and operative relief given between periods of exacerbation.

Tuberculosis of the cæcum, like tuberculosis elsewhere in the body, is usually secondary to involvement of the lungs. It is held by some, however, that the infection of the cæcum generally occurs through the blood or lymph stream.

In removing this type of intestinal tuberculosis the lesion should be treated very much as though we were dealing with carcinoma of the bowel. The resection should include 4 inches of bowel above and below the involved segment together with all the lymph nodes in the mesentery of the resected intestine. Under spinal anesthesia resection of the terminal ileum and ascending colon was performed in both cases, and a lateral anastomosis of the ileum to the transverse colon was established.

The Mikulicz operation was not considered adaptable for these cases, the lesions being altogether too extensive to make use of this comparatively safe and simple procedure.

One of these patients died at his home, of pulmonary hemorrhage, 10 months following the operation. The other patient, four years following operation, has gained 40 pounds in weight, has no intestinal nor pulmonary symptoms, and is at present reported to be in excellent condition.

Spinal anesthesia seems particularly suitable to cases such as these with advanced pulmonary lesions. The perfect relaxation obtained facilitates the technique of the operation, and shock is appreciably minimized.

CONCLUSIONS

1. The history of pulmonary tuberculosis, recurrent attacks of diarrhea, colicky pain, and tenderness with the presence of a tumor-like mass in the right iliac fossa, should guide us in establishing a diagnosis. Tuberculosis of the cæcum may have acute exacerbations, which resemble an appendiceal abscess, presenting a tender, painful mass, rigidity, fever, and leucocytosis.

2. Resection of the involved bowel and lymphatic glands is a satisfactory form of treatment in selected cases of proliferative tuberculosis of the cæcum.

LOCAL ANESTHESIA IN APPENDECTOMY¹

By C. F. STOREY, Lieutenant (Junior Grade), Medical Corps, United States Navy

On first thought it might seem a waste of time to discuss before a body of experienced physicians such a commonplace surgical procedure as an appendectomy, but, considering the mortality and morbidity of this condition, we realize that anything that will lessen the mortality might well be brought to our attention. It is with this in mind that I have undertaken this discussion in which I hope to point out the ease, simplicity, and safety of appendectomy under local anesthesia.

During operation the great danger is the spread of infection, due to rough or careless handling or from the struggling incident to the induction of general anesthesia. Numerous cases have been recorded, frequently with disastrous results, where such trauma has resulted in the dissemination of localized intra-peritoneal collections of pus, and in using general anesthesia this possibility merits our greatest consideration.

In acute suppurative processes there is the greatest necessity of maintaining a silent field if we are to prevent the spread of localized infective processes. The increased respiratory excursion of the intestines, caused by strenuous breathing, struggling, retching, and vomiting, incident to general anesthesia, should be obvious to everyone. It should also be borne in mind that one's most careful endeavor to prevent the dissemination of infection by meticulous care to avoid soiling during operation, may all too frequently be nullified by the intestinal turmoil following a painstaking operation under general anesthesia.

Postoperative retching and vomiting, plus the bodily activity of the patient as he is recovering from the effects of the general anesthetic, are common causes of the spread of infection. Secondary

¹ Read before the clinical conference at the Great Lakes Naval Hospital, Nov. 6, 1930.

operations following appendectomy have led to the observation that where general anesthesia is used, not infrequently a great excursion has taken place in many of the organs, particularly the cecum, sigmoid, transverse colon, stomach, and great omentum, whereas, upon reopening the abdomen following the use of local infiltration or regional block, the organs are seen to lie in approximately the same position in which they were left.

In all acute infective processes the advantages of having a quiet field are too manifest to necessitate elaboration. Under local anesthesia this primary requisite to a successful operation is obtained.

Before proceeding with a discussion of technique, I would like to mention one more factor, which I believe physicians in general all too often overlook. This is the comfort, both physical and mental, of the patient. We are too prone to consider Smith, J., a case of appendicitis instead of John Smith, an individual, a human being like ourselves. The relief of pain is just as much a part of our duties as is the saving of life, and anything that will add to the peace of mind and ease of body of our patients should be done with the deepest sense of duty. There is not one of us who has not heard a patient remark that he dreads the anesthetic worse than the operation itself. And all, no doubt, have observed the suffering with "gas pains" that are the rule rather than the exception in patients who have been subjected to general anesthesia. Under local anesthesia these objectionable conditions are done away with. The operation is approached without fear and the postoperative period is converted from one to be dreaded to one of comparative comfort.

TECHNIQUE OF INJECTION

It does not lie within the scope of this paper to discuss the merits and demerits of the various anesthetic agents used in local work. Suffice it to say that novocaine with adrenalin has been found the most satisfactory. The novocaine may be used in strengths from 0.25 to 1 per cent. At this hospital we use 0.75 per cent with 6 drops of adrenalin (1-1,000) per 100 c. c.

A point is selected about one-half inch below the mid-point of a line running from the anterior superior iliac spine to the umbilicus, and an initial wheal is raised, about 2 c. c. being injected intradermally. From this point the needle is directed outward and backward toward the loin, until it is felt to pierce the fibers of the external oblique. This layer can be easily recognized, as the needle can be felt to plunge through it. The patient may exhibit a slight tinge of pain as the muscle contracts, as it resents the intrusion of the needle. The injection is continued until between the internal oblique and transversus abdominis. Ten to twenty c. c. are injected at this point, the

needle is backed up but not entirely withdrawn, and a second injection is made with needle directed toward the angle of the last rib, then directly upward, then toward the umbilicus, then medially to the rectus muscle, downward and medially toward the symphysis pubis, downward toward the external inguinal ring, and so on until we have completely encircled the field, about 10 c. c. being injected at each site. We then put about 10 c. c. just beneath the external oblique aponeurosis to permit wide separation of this layer. The needle is now almost withdrawn and directed straight downward at right angles to the skin, piercing the external oblique, internal oblique, and transversus abdominis in succession. Care is taken in this instance, as in all instances, to keep the fluid ahead of the needle. This prevents the piercing of nerves and blood vessels, and when the peritoneum is reached, it serves to "balloon" out or "float" it, thereby keeping it out of harm's way. About 10 c. c. are injected between the internal oblique and the peritoneum. The entire injection should not require more than three minutes. We now inject about 10 c. c. subcutaneously along the line of our incision, which serves not only as a marker but also takes care of any superficial nerves from the opposite side. This completes the anesthesia. An average of about 80 c. c. are usually required, but varying amounts of from 60 to 120 c. c. may be necessary, depending on the size of a patient, the thickness of his abdominal wall, his emotional reaction, etc. The toxicity of the drug is not great, 385 c. c. of a 1 per cent solution having been used without toxic effects. Labat states that one can use as high as 250 c. c. of 0.5 per cent solution in all cases without fear of untoward effects.

TECHNIQUE OF OPERATION

Under local anesthesia, as under general, the incision is a matter of choice. At this hospital we use the transverse or modified Elliot incision. It is a transverse incision about 3 inches long, extending from the outer border of the rectus muscle to a point medial to and directly opposite the anterior superior iliac spine. The bad results which follow vertical incision are probably directly due to nerve injury. Since the nerves immerge from the spinal cord, curve around anteriorly, and enter the rectus muscle at right angles, any vertical incision necessarily interrupts their continuity. The points that recommend the transverse incision are:

1. Sufficient room.
2. Conservation of the nerve and blood supply.
3. Cosmetic effect of closure.

The subcutaneous fat and superficial fascia are also incised transversely, and all bleeding points, having been carefully tied, are retracted in a vertical direction. This exposes the fascia of the exter-

nal oblique muscle, which is split in the direction of its fibers, which run diagonally from above downward and inward. In this procedure we keep as far laterally as possible, since the cecum lies laterally. Retraction is then made in the opposite or horizontal plane, which exposes the internal oblique; this muscle, together with the transversus abdominis, both of whose fibers run transversely, is then split. This is accomplished by carefully passing a pair of scissors through the muscles, followed by the index finger, and then opening them. Further exposure of the peritoneum can be accomplished by the fingers alone. Retraction is now made in a vertical direction, the peritoneum picked up and, having made sure that no gut has been caught, is opened in the usual manner. If a good anesthetic has been obtained we may expect to find a negative intra-abdominal pressure, and the intestines, instead of protruding from the abdomen, as is so often the case under general, will fall away from the abdominal wall, allowing the surgeon an excellent view of existing conditions. With the transverse incision previously described, the appendix can usually be found without difficulty. It is delivered, the meso-appendix injected with 2 or 3 c. c. of novocaine, and removal completed in the usual manner. When complications are found to exist, they are cared for in the same way as if any other anesthetic had been used. There is some pain incident to manipulation of the intestines, due to a pulling on the mesentery, but careful handling enables us to make the procedure practically painless and at the same time will prevent the undue trauma so likely to be incurred when the patient is under general anesthesia. The abdomen is closed in layers in the usual manner.

The advantages of local anesthesia over general in appendectomies may be summed up as follows:

1. Local anesthesia gives a quieter field during the operative and postoperative periods, thereby helping to prevent the dissemination of infective materials.

2. It gives us a negative intra-abdominal pressure rather than the positive pressure found when the general anesthesia is used.

3. It can be used without danger in such conditions as respiratory tract infections, nephritis, cardio-vascular disease, diabetes mellitus, and pronounced secondary anemias, where inhalation anesthetics are contraindicated.

4. It lessens the possibility of postoperative pneumonia.

5. "Gas pains," so common after general anesthetics, in addition to nausea and vomiting, are almost unknown where local anesthesia is used.

6. It eliminates what is for many patients the most dreaded and most trying part of a surgical procedure, the taking of a general anesthetic.

7. It is comparatively inexpensive, does not require a trained assistant to administer, can be given in two or three minutes, and at any time or any place. Novocaine will keep indefinitely.

8. The surgeon has the additional advantage of being able to converse with the patient as to his symptomatology during the operation.

9. Nourishment in the form of fluids can be given immediately after the operation without untoward symptoms.

10. The dangers of an anesthetic death are practically eliminated.

VITILIGO CASE REPORT

By H. L. WYATT, Lieutenant, Medical Corps, United States Navy

Vitiligo (1) and leukoderma are synonymous and interchangeable terms, although some authors use the former for the acquired disease and the latter for the congenital loss of pigment, also designated partial albinismus. Vitiligo (2) is an acquired cutaneous achromia characterized by variously sized and shaped single or multiple patches of milk-white color, usually presenting hyperpigmented borders and a tendency to enlarge peripherally.

The cause of the disease is unknown, but a relationship to disease of the suprarenal capsule has been suggested (McCall Anderson). It rarely begins before the tenth or after the thirtieth year, and according to statistics is more frequent in tropical countries (India) and in the dark races.

Anatomically the whitish spots are seen to be wholly devoid of coloring matter, whereas the surrounding brown discoloration shows hyperpigmentation. Absence of pigment, producing color changes, is the only symptom of vitiligo.

The diagnosis is usually not difficult. It might be confused with chloasma, morphea, leprosy, and syphilis. In vitiligo the spots always have convex borders which is not the case in chloasma. In morphea the structural changes in the skin are evident, and in leprosy the spot is anesthetic and other signs are present. Syphilis is differentiated by other signs of the disease and by the examination of the blood and spinal fluid.

The treatment of the disorder is unsuccessful. The disfigurement causes distress in sensitive individuals.

REPORT OF CASE

J. H. R., A. S., United States Navy, age 24 years, a full-blooded American Indian, enlisted August 1, 1930. Father died of tuberculosis; mother died, cause unknown; no brothers or sisters known. Previous diseases: Measles

and mumps, as a child. He was told that he had tuberculosis at age of 9 years but he is unable to give details of this illness. He denies any other diseases. Physical examination is entirely negative excepting for the characteristic white spots, symmetrically distributed over the neck, chest, and the extremities. The spots vary from the size of a quarter to the size of the palm of the hand.

According to the man, the condition began in 1925, when small white spots gradually appeared on both hands, to be followed soon by similar spots on the feet. In the course of three years the neck, body, and extremities became spotted with these areas of loss of pigment. Since 1928 there have been no new spots. In a few lesions on both legs there has been a return of pigment to affected areas. There has never been any pain or discomfort connected with the condition and the man does not appear worried or distressed, and does not care for any attempt at treatment. The Kahn test of his blood is negative.

CONCLUSION

Although vitiligo is not a rare disease, it is not frequently seen among naval personnel.

REFERENCES

- (1) Stelwagon, H. W.: A Treatise on Diseases of the Skin; eighth edition, page 639.
- (2) Ormsby, O. S.: A Practical Treatise on Diseases of the Skin; third edition, page 585.

A SIMPLE METHOD OF GASTRIC ANALYSIS

By W. H. FUNK, Lieutenant Commander, Medical Corps, United States Navy

The following method of gastric analysis was demonstrated at a clinic of Dr. Franklin W. White at the Boston City Hospital. It has been used at the United States Naval Hospital, Portsmouth, N. H., for the past three months.

The tube used is the Levin gastro duodenal catheter manufactured by the Penn Surgical Manufacturing Co., Philadelphia, Pa. This is simply a long rubber catheter, size 14, 15, or 16 French, length 50 inches. There is no metal tip. The tube is passed through the nostril as for nasal feeding. After the contents of the fasting stomach have been obtained by aspiration, a test meal of 100 c. c. of 10 per cent alcohol solution is introduced through the tube. Specimens for gastric analysis are taken at 30 minutes and 1 hour after the introduction of the test meal.

The advantages of this method are as follows:

1. There is very little discomfort to the patient. Retching, gagging, etc., are not experienced with such frequency as occur with the passage of the ordinary tube or Rehfuß tube through the mouth.

2. Contents obtained for laboratory chemical analysis are clear and do not require filtering. Titration for free and total acidity can be done immediately.

The values obtained for free and total acidity seem to parallel or run slightly higher than those obtained by the Ewald test meal with the Rehfuss tube. Tests run by each of these methods on the same patient on successive days have given practically identical values.

These tubes may also be used for nasal feeding, duodenal drainage, trans-duodenal lavage and for continuous gastric lavage and drainage in post operative abdominal cases complicated with prolonged nausea and vomiting.

NAVAL RESERVE

APPOINTMENTS IN THE NAVAL RESERVE

Name	Rank and class	Appointed
Andrews, Clayton Farrington.....	Lieutenant commander, MC-V (S).....	Nov. 19, 1930
Brecher, William.....	Lieutenant (junior grade), MC-V (G).....	Sept. 27, 1930
Dickinson, Everett Homer.....	Lieutenant, MC-V (G).....	Oct. 1, 1930
Dix, Willie Kerns.....	Lieutenant (junior grade), MC-V (G).....	Sept. 19, 1930
Dwyer, Francis William.....	do.....	Aug. 25, 1930
Fulcher, Joseph.....	do.....	Dec. 5, 1930
Fuller, Paul Milton.....	do.....	Nov. 20, 1930
Gallaher, Charles Schley.....	do.....	Dec. 5, 1930
Helmkamp, George Frederick.....	do.....	Oct. 17, 1930
Hungate, Carroll Paul.....	do.....	Sept. 13, 1930
Isaacks, Herbert Ernest.....	do.....	Nov. 15, 1930
Johnson, Clarke Moore.....	Lieutenant, MC-V (S).....	Apr. 26, 1930
Jones, Walter Colquitt.....	Lieutenant (junior grade), MC-V (G).....	July 21, 1930
Love, Andrew Alexander.....	do.....	Sept. 3, 1930
McMahon, Henry Easton.....	do.....	Nov. 3, 1930
Parker, Leon Ocel.....	Lieutenant, MC-V (S).....	Sept. 25, 1930
Robertson, Charles Glasgow.....	Lieutenant, (junior grade), MC-V (G).....	Nov. 29, 1930
Welsh, Clyde Lionel.....	do.....	Nov. 25, 1930
Wood, Russell William.....	do.....	Nov. 15, 1930

PROMOTIONS IN THE NAVAL RESERVE

Name	From—	To—
Adams, Thomas S.....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.
Legge, Kenneth D.....	Lieutenant, MC-V (G).....	Lieutenant commander, MC-V (G).

TRANSFERS IN THE NAVAL RESERVE

Barney, Leon A.....	Lieutenant (junior grade), MC-F.....	Lieutenant (junior grade), MC-V (G).
Kretzler, Harry H.....	Lieutenant (junior grade), MC-V (G).....	Lieutenant (junior grade), MC-F.
Livingston, Stanton K.....	do.....	Do.
Meehan, George E.....	Lieutenant (junior grade), MC-F.....	Lieutenant (junior grade), MC-V (G).
Welsh, Clyde L.....	Lieutenant (junior grade), MC-V (G).....	Lieutenant (junior grade), MC-F.
Wirig, Marres H.....	do.....	Do.

NOTES AND COMMENTS

POSTGRADUATE TRAINING

In November, 1929, a board was formed to estimate the current needs as to the number of medical and dental officers required in each of the several specialties, to select officers for assignment to courses of postgraduate training in order to meet these needs and to formulate the bureau's policies in regard to the general matter of postgraduate training.

The board has since met at frequent intervals. Its studies have resulted in the arrival at more exact estimates as to present and expected specialist needs, and its functioning has already brought about some gratifying progress in the way of a program which is now removing the shortage in certain fields.

During 1930 medical officers were assigned to courses of postgraduate training as follows:

Internal medicine.....	13	Clinical laboratory.....	2
Aviation medicine.....	5	Pathology.....	1
Eye, ear, nose, and throat.....	5	Tropical medicine.....	1
Urology.....	4	Physiotherapy.....	1
X ray.....	3	Tuberculosis.....	1
General surgery.....	3		
Neurology and psychiatry.....	3	Total.....	44
Bronchoscopy.....	2		

At present the estimated shortages in the various fields are as follows:

Clinical laboratory.....	39	Radiology.....	10
Internal medicine.....	38	Aviation medicine.....	10
Pediatrics.....	28	Public health.....	9
General surgery.....	24	Physiotherapy.....	9
Neurology and psychiatry.....	20	Bronchoscopy.....	6
Pathology.....	19	Urology.....	5
Gynecology and obstetrics.....	19	Supply depot.....	4
Orthopedic surgery.....	17	Chemistry.....	1
Field service.....	12		
Submarine and deep diving.....	12	Total.....	293
Eye, ear, nose, and throat.....	11		

The bureau is constantly seeking personnel having knowledge and experience in special fields in order to meet special needs at hospitals,

certain naval stations, special units at sea, at foreign shore stations, and with expeditionary forces.

The bureau desires to assist those who are anxious to develop themselves in a chosen field. Assistance is being given in the following ways:

(a) For internes, obstetrical and gynecological opportunity in civilian institutions as part of the interne year.

(b) For younger medical and dental officers, particularly those in the rank of lieutenant, assignment to the basic course at the naval medical and dental schools.

(c) Assignment, preferably later and after the basic course, for lieutenants in the Medical and Dental Corps, when practicable, to naval hospitals and other naval stations for special temporary duty under instruction in a professional or military specialty, such assignment constituting in the bureau evidence that the individual has begun to definitely associate himself with a chosen specialty.

(d) Favorable action, when practicable, upon requests for civilian courses of postgraduate instruction, preferably after the individual has had the basic course at medical department schools and a special assignment under instruction in a naval activity.

(e) Assignment of established specialists to refresher courses in their specialties from time to time as may be expedient.

THE ESSENTIALS OF SMALLPOX VACCINATION

In the United States Public Health Service weekly report of November 14, 1930 (vol. 45, No. 46), James P. Leake and John W. Force have contributed an article of distinct importance and value to all those, such as naval medical officers, whose duties involve smallpox vaccination on an extensive scale.

The article is reprinted here in full:

THE VACCINATION REACTION

When potent smallpox vaccine is applied below the superficial layers of the epidermis, irrespective of the method used for penetrating these layers, a reaction will take place, reaching a maximum which may be observed in from 1 to 14 days, depending on the degree of immunity of the subject. Absence of this reaction indicates that the vaccine is incapable of protecting against smallpox and not that the subject is immune. Any one of the forms of this vaccination reaction, to be described below, is evidence of a successful vaccination.

If the subject has never been immunized by smallpox or by previous vaccination, the reaction will manifest itself as a primary vaccinia. A papule appears at the inoculation site from one to six days following the vaccination. This becomes vesiculated from one to three days later, the vesicle being surrounded by a narrow red margin or areola. This vesicle increases in diameter at the rate of approximately a millimeter a day. On about the seventh day the skin

outside the areola begins to turn red, and this area of redness rapidly extends until the eighth to fourteenth day (usually the ninth or tenth), when the maximum diameter of the area is reached. After this day the area rapidly fades, and the vesicle, already crusted in the center, extends slightly for a day or two, and then is soon completely replaced by a dark brown crust, though still surrounded for some days by a narrow areola. If kept dry, the crust will separate in approximately three weeks from the day of vaccination, leaving a red scar, which becomes white in a year or so. For a day or two during the development of the area the axillary lymph nodes are usually swollen and tender, and fever and headache are generally present. All these symptoms abate promptly, often before the maximum of the local reaction is reached.

If the subject retains partial immunity, either through previous vaccination or an attack of smallpox, the reaction will be accelerated in development, shortened in time, and decreased in severity. The papule will appear earlier, the vesicle will be smaller, and the area will be less extensive at the maximum of the reaction, which may occur at any time from four to seven days after vaccination. In this event the reaction is considered a vaccinoid (accelerated reaction or secondary vaccinia).

If the immunity is very high, the acceleration may be so great that the reaction consists only of a papule and areola, with the maximum diameter in from 8 to 72 hours after vaccination. In this case the reaction is designated reaction of immunity (immediate reaction). The time element of this reaction is of prime importance. If the papule and areola do not appear until the third day and there is no vesiculation, the reaction is not that of immunity but is due to an impotent vaccine, and the vaccination should be repeated with a fresh lot. Also with vaccine of less than full potency, a reaction similar to a reaction of immunity may be produced in a person who is not fully immune. This can not be considered a successful vaccination.

NECESSITY FOR KEEPING VACCINE VERY COLD

The expiration date on a package of smallpox vaccine indicates its expectancy of moderate potency under ordinary conditions. For reading reactions of immunity and for vaccinating persons actually exposed to smallpox, vaccine of full potency should be used, and the temperature of storage should therefore be lower than the upper limit stated on the package. Smallpox vaccine can not be kept too cold; it deteriorates even in an ice box. The freshest possible vaccine should be obtained; and this can be secured by arranging for small and frequent shipments direct from the manufacturing laboratory. The packages should be kept in the ice-making compartment of a refrigerating machine, or if a mechanical refrigerator is not available, in constant contact with ice, not merely on a shelf in an ice box. Metal or glass containers for storing in ice are convenient; but if there is occasional access to outside air, or changes in temperature, needles (except those in glass-sealed tubes) should be removed from the packages to prevent rusting. For use in the field, large quantities should be transported in ice-cream freezers, small quantities in rubber-stoppered test tubes, packed with shaved ice in the inner compartments of vacuum bottles. A good vacuum bottle will keep vaccine packed in this way ice cold up to 24 hours.

PREPARATION OF THE SITE FOR VACCINATION

The skin of the upper arm in the region of the depression formed by the insertion of the deltoid muscle should be gently but thoroughly cleansed with

acetone on sterile gauze or cotton and wiped or allowed to dry for a few seconds. Acetone is suggested as a cleansing agent rather than alcohol for the following reasons:

1. It is a more efficient cleanser.
2. It is cheaper.
3. It is not denatured with substances which may possibly affect the vaccination result.
4. It evaporates more rapidly.
5. Approximately 200 vaccinations performed after the use of acetone and alcohol on alternate subjects resulted in more successful vaccinations with acetone than with alcohol.

METHODS OF VACCINATING

1. *The multiple pressure method.*—In each package of capillary tubes there will be found a perforated rubber bulb with a diaphragm across the interior of the neck. Push an unbroken capillary tube through the neck of the bulb until about a quarter of an inch of the capillary tube appears beyond the bulb. Break the tip which has been pushed through and withdraw the tube until the broken end lies in the neck of the bulb. With sterile gauze, break the other tip of the capillary tube and drop the contents on the spot to be vaccinated by squeezing the bulb with the finger over the perforation.

The needle, which should be new, sharp, and sterile, is held parallel to the skin, with the forefinger and middle finger of the right hand above the needle and the thumb below, the needle pointing to the operator's left. The needle should be crosswise of the arm, so that the thumb of the operator does not interfere by hitting the skin. The side of the needle point is then pressed very firmly and rapidly into the drop about 30 times within 5 seconds (10 times for primary vaccinations), covering an area not over one-eighth of an inch in diameter. The area covered by the pressures can be kept small by steadying the last two fingers of one's hand against the arm of the person being vaccinated and by moving the hand from the wrist only. This rapid up-and-down motion of lifting the needle and pressing it against the skin should be quite perpendicular to the skin and needle and not in the direction of the long axis of the needle. The point is not driven into the skin, but at each pressure the elasticity of the skin will pull a fraction of an inch of the epidermis over the point of the needle so that the vaccine is carried into the deeper layers of the epidermis. If the skin has not been unduly rubbed in cleansing and if the pressure is entirely perpendicular to the needle, no signs of bleeding should occur and all evidence of trauma will fade out in less than 6 hours. Immediately after the pressures have been made, the remaining vaccine is gently wiped off the skin with sterile gauze and the sleeve pulled down, the whole operation of pressing and wiping taking less than 10 seconds—it is not necessary to rub the vaccine in, as with the other two methods.

The advantages of this method are its mildness and painlessness, the fact that it is more rapid than any other effectual and safe method, the very superficial implantation, the leaving of the epidermis nearly intact, the fact that no control site is necessary for estimating the amount of trauma in a reaction of immunity (since the evidence of trauma due to the operation has usually disappeared before the first observation for an early reaction is made), and the fact that the vaccine is wiped off immediately so that the uselessness of a dressing is obvious to the person vaccinated.

2. *The method of incision or linear abrasion.*—The vaccine is dropped on the skin as described for the multiple-pressure method. The underside of the arm

is then grasped with the vaccinator's left hand, in order to stretch the skin where the vaccine has been dropped. This tension is maintained while the vaccine is being inserted. With the point of a sterile needle pressed through the drop of vaccine "a very slight scratch, not exceeding the eighth part of an inch" (Jenner), is made down the arm. With the side of the needle or the flat end of a sterile toothpick, the vaccine is then gently rubbed across the scratch for at least 15 seconds.¹ The scratch should penetrate the epidermis, but not draw blood. The friction across the scratch may cause a slight oozing of blood-tinged serum, but this should not be sufficient to wash the vaccine out of the scratch.

3. *The drill method.*—In the drill method the epidermis is perforated by a small drill with a sharp cutting edge 2 mm. in width. The drill is made of carbon steel and the tip can be sterilized by flaming. The drill method is preferable for quantitative investigations or where there is a tendency to vaccinate too large an area, because of the uniformity of size of insertion.

If in capillary tubes, the vaccine is prepared for insertion as previously described, but is not dropped on the skin until after the derma has been exposed. The skin is tightly drawn and the drill pressed against it perpendicularly. A single rotary turn is then made without altering the pressure. This will detach a small flake of epidermis, which should be brushed off with the edge of the drill. This exposes a circle of derma about 2 mm. in diameter and, if skillfully done, should cause no bleeding. The vaccine is dropped on this circle of exposed derma and rubbed in with a sterile toothpick, as described under the method of incision.

If the number of persons being vaccinated is large enough to warrant the expenditure of all the vaccine in a vial container at one clinic period, the vaccine may be supplied in vials and transferred directly to the arm with the sterile toothpick.

NUMBER OF INSERTIONS

Multiple insertions should be used under the following conditions:

1. In case of exposure to smallpox.
2. In case of failure of previous vaccination.
3. In case there is any doubt as to the full potency of the vaccine on account of possible adverse conditions of transportation or storage.
4. In case the subject is not likely to return for revaccination in the event of failure.

When multiple insertions are used, they should be made not less than 2.5 cm. apart. A capillary tube should be used to each insertion.

PRECAUTIONS

The vaccination site should not be exposed to direct sunlight until dry. Dressings are unnecessary and are harmful if permitted to remain on the arm. The small vesicles produced by any one of the above methods are reasonably tough and will dry without rupturing unless macerated by the excessive heat and moisture present under a vaccination shield or other nonmobile covering. This maceration is not prevented by the presence of openings in the vaccination shield. Vesicles and crusts should be kept dry. If necessary to prevent the soiling of the clothing, a fold of sterile gauze may be attached to the garment, not to the skin. Very rarely a severe "take" may require a few days of antiseptic dressings.

¹ This recommendation is based on the results of a series of tests with different vaccines.

All primary vaccinations should be observed at the end of 10 and 15 days, and revaccinations should be observed in 2 and 4 days, in order to detect a possible reaction of immunity. The vaccination should be considered successful as soon as this reaction of immunity appears and begins to subside, provided vaccine of full potency has been used. A test for full potency is that the vaccine should give more than 50 per cent of vaccinoid reactions in the group of people vaccinated more than 10 years previously.

Small insertions are insisted upon because the diameter of the lesion is dependent upon the area of the insertion, and the rapidity of healing is dependent upon the size of the lesion.

THE VACCINATION CERTIFICATE

The character of the vaccination reaction should be indicated on the vaccination certificate by noting the day of greatest extent of redness. This may be done conveniently by checking the day on the following record:

	Reaction of im- munity	Vaccinoid	Vaccinia
Days after vaccination.....	1 2 3	4 5 6 7	8 9 10 11 12 13 14

Encircle the number of the day after vaccination on which the greatest extent of redness was observed.

The number of successful insertions, the lot number of the virus, and the expiration date should also appear on the record.

POSTVACCINATION ENCEPHALITIS

Dr. Charles Armstrong, United States Public Health Service, has prepared a memorandum on postvaccination encephalitis, which condition has been of frequent enough occurrence in certain countries (Holland, Germany, and England) to cause the Governments of those countries to alter their vaccination laws. In Holland 229 cases have been reported; in England, 139; in Germany, 112; and in the United States, 41 (11 definite cases in 1930 and several possible additional cases under investigation).

Doctor Armstrong's memorandum, in part, is as follows:

Epidemiology: Usually follows primary vaccination—rarely secondary—rare under one year. Age distribution cases United States typical, girls slightly more often attacked than boys. There seems to be no relation to the kind or strain of virus used and many of the cases have followed “takes” which apparently had followed normal courses and certainly were not unduly severe.

Onset: Usually sudden and with striking tendency to begin 10–14 days following vaccination, i. e., when latter is at its height.

Symptoms: Fever, vomiting, stupor or coma, and headache usual—convulsions, paralysis or paresis, and sensory disturbances variable.

Retention or incontinence of urine or feces common. Reflexes usually altered.

Pathology: Cellular proliferation and demyelization surrounding blood vessels of brain and cord, largely confined to white matter. Similar to encephalitis occasionally following measles, smallpox, chicken pox, whooping cough, etc.

Prognosis: Twenty-five to fifty per cent of cases fatal; varies somewhat in different countries.

Recovery: Usually but not always without sequelæ.

Cause: Undeniable and definite association with vaccination but the exact character of this relationship is unknown; some contend that the vaccine virus per se is the cause; others think the vaccine virus serves to "light up" some other virus—its identity as yet undetermined. Seems clear from clinical picture, rarity of sequelæ, failure of attempts to convey to animals and from pathology that the condition is not due to poliomyelitis, epidemic encephalitis, or herpes virus.

Treatment: Symptomatic care to avoid bed sores; serum of animals immune to vaccine has been tried on very limited number of reported cases—results indefinite. Convalescent serum or whole blood from recently vaccinated persons has been used on less than 20 reported cases. Reporters favorably inclined toward its use. Germany has made supply of serum available for that country.

Prevention: Few cases reported in vaccinations under one year; this age recommended for primary vaccinations.

Administration: England has modified prescribed vaccination technique, recommending one small insertion in place of three as previously done.

Germany has liberalized her compulsory laws and made serious vaccination complications compensatable.

Holland temporarily has suspended compulsory vaccination except in presence of smallpox.

THE SYPHILOLOGY OF TO-DAY AND TO-MORROW

In the Herman L. Biggs lecture for 1929 John H. Stokes expressed some thoughts of great interest to those whose work, as in the case of naval medical officers, consists largely of problems in syphilology. The lecture appears in the Archives of Dermatology and Syphilology, 1930, XXII, 201.

The contrast between the general support accorded the organized fight against such diseases as scarlet fever, tuberculosis, and diphtheria and the lack of such support for the fight against syphilis is a striking commentary of the status of syphilis control to-day. Syphi-

lis as a public-health problem is all but ignored, and yet in the area of the United States in which syphilis has been reported since 1920 there have been 35,000 more cases of syphilis reported than of scarlet fever; 79,000 more than of all forms of tuberculosis; 500,000, or nearly one-third, more cases of syphilis than of diphtheria; three times as much syphilis as smallpox; and five times as much syphilis as typhoid fever.

Syphilis is controllable by treatment of the infected person, and a decline has been shown to have occurred in Great Britain and in Germany. At present there are no authentic figures pointing to a reduction in the incidence of venereal diseases in the United States, but such statistics may be forthcoming when the studies undertaken by the United States Public Health Service have covered a longer period of time. The measurement of the decline or increase in the United States will be of importance, since it will demonstrate the relative value of an individualistic scheme of dealing with syphilis, as contrasted with a State-controlled clinic system or a panel or health insurance. The outstanding issue in this special field of public health is the problem of the individual practitioner versus the organization. The problem is no different in this than in other fields of medicine, but it is more acute. If experience here in America does not prove that the individual practitioner is receiving the same results that organized and socialized medicine is securing in Europe, the American public will stampede organizationward as it has in Chicago. The part of the medical school needs to be carefully considered. If from a central group of interested and self-developed specialists one could train leaders in this field and could instill in students "the fear of God and the spirochete and the need for consultation," a solution of the problem might be in sight.

If the individual method does not meet the requirements of the situation, the most desirable type of organization is the center or clinic under combined medical, academic, and business auspices set up for the practice, teaching, and research in the field of venereal diseases. The foremost need of this organization is the full-time director and staff. Of equal importance are the personal enthusiasm and inspirational power of the chief. Adequate equipment, location, and convenient hours are next in line and the work should be financed on a small fee, pay-as-you-go-and-can basis. Physicians, perhaps with a State subsidy, must organize to take care of the whole field, pay and free, or be displaced.

The ability to hold the patient to treatment is one of the best measures of the success of the physician or center. Results of a special study show that failure to impress the patient with the medical facts, reactions to treatment, especially intramuscular injections, which in-

terfere with work, the hours of the clinic which conflict with those of the patient's occupations, together with illness and change of domicile, are in the order named the chief reasons for failure to complete treatment. Future progress may well lead to abandonment of efforts toward compulsion and toward directed effort to educate the patient and to make treatment cheap or free, safe, accessible, attractive, and comfortable. Properly controlled advertising will be a necessity in the conquest of venereal diseases in this country—controlled by organized medicine and the State. The medical society, the university medical center, and the public-health officers of some one of the larger cities are the agencies best fitted to attempt a solution of the problem.

Research workers in the field of syphilis must meet the need for a specific differential staining or develop the local serum reaction. For this there is a foundation in the work of Kolmer and Klauder on the Wassermann test, of Elliott on the mirco-Kahn test, and perhaps in some adaptation of Kline's slide precipitation tests. Next they must make it possible to answer the question, "Can syphilis be cured?" The work of Warthin has demonstrated the survival of the syphilitic process and even of the organism itself in many cases at autopsy even after modern treatment. Research in the clinical field is essential. While organization seems to offer the brightest prospects in dealing with the patient as a public-health problem the individualistic approach to research is the most promising.

No program is complete which neglects the ethical and social values involved. The broad educational program of the social hygienist is a vital part of a well-rounded plan. It is in this welding of the public health and the social hygiene points of view that Herman Biggs led the way.

ASYMPTOMATIC NEUROSYPHILIS

Joseph E. Moore and H. Hanford Hopkins, of the syphilis division of the medical clinic, Johns Hopkins Hospital, writing in the November 29, 1930, number of the Journal of the American Medical Association, present the results to date of their extensive studies in asymptomatic neurosyphilis. The summary and conclusions of their article follows:

1. Data regarding the outcome of 123 patients with asymptomatic neurosyphilis (including 55 whose admission diagnosis was early and 68 late syphilis) observed over an average period of seven years are presented. Conclusions are based on repeated clinical and spinal fluid reexaminations.

2. The patients are classified in three groups (1, 2, and 3) on the basis of the intensity of the spinal fluid changes.

3. Spontaneous regression to normal of positive spinal fluid observations of any degree of intensity is a rare phenomenon.

4. Of 14 patients with group 1 spinal fluids, 6 are clinically and serologically well, 2 have developed clinical neurosyphilis and in 6 the present status is questionable.

5. Of 73 patients with group 2 fluids, 50 are clinically and serologically well, 5 have developed clinical neurosyphilis (of whom 2 developed dementia paralytica and 1 tabes), and in 18 the present status is questionable.

6. Of 36 patients with maximal (group 3) fluid changes, only 10 are well. Twelve have developed clinical neurosyphilis (of whom 7 developed dementia paralytica and 3 tabes), and in 14 the present status is questionable.

7. The presence of a group 3 spinal fluid, early or late in the course of syphilitic infection, is strong presumptive evidence of liability to the development of parenchymatous neurosyphilis.

8. Since the average observation period is short, it seems certain that the figures given for the incidence of clinical neurosyphilis are minimal and that from the 38 patients now classified as "status questionable" further examples will develop.

9. Eleven patients of the series are dead, of whom 5 died of neurosyphilis.

10. The presence of a positive spinal fluid in patients with early or late syphilis who show no objective neurologic abnormalities is of grave prognostic import. Generally speaking, the ultimate danger to the patient is roughly proportional to the intensity of the spinal fluid changes.

11. On the other hand, a negative spinal fluid in early or late syphilis is, subject to certain qualifications, a practical guarantee of safety for the future so far as the development of neurosyphilis is concerned.

12. These facts being true, routine spinal puncture is an indispensable part of the management of every patient with syphilis.

IS *FRAMBOESIA TROPICA* A NOSOLOGIC ENTITY?

In an article bearing the above title, Lieut. Surg. Isao Miyao, Japanese Navy, presents (in the Philippine Journal of Science, November, 1930) an exceedingly comprehensive argument in support of the view that yaws and syphilis are distinct disease entities. The substance of his thesis is based largely on the studies conducted by him and others at the division of biology and serum laboratory, Bureau of Science, Manila.

He states that the fundamental biologic difference between the two treponemas lies in the pathogenesis of the two diseases, the yaws organism being epiblastotropic and the syphilis organism being panblastotropic, with preference for the mesoblastic tissues.

He mentions the following differential points:

1. INITIAL LESION

Yaws: Treponemas remain in the superficial layer of the skin, producing downgrowth of the epidermis and upgrowth of granulation tissue, the resulting efflorescence being a papilloma, or yaw.

Syphilis: Treponemas penetrate early into deeper layers of the skin, producing deep, hard edema—a chancre.

2. IMMUNITY

Yaws: Because of the failure to penetrate into the deep skin layers, immunity is late in developing. Treponemas immunize against themselves earlier than against treponemas of syphilis.

Syphilis: Immunity develops much earlier, and immunity is developed sooner against syphilis than against yaws.

3. METASTATIC LESIONS

Yaws: The metastatic lesion is identical in character with the initial local lesion.

Syphilis: Metastatic lesions do not resemble the initial lesion.

4. CHEMOTHERAPY

Syphilis is less amenable to chemotherapeutic measures on account of infection in mesoblastic tissues.

5. CONGENITAL INFECTIONS

Miyao's explanation of the nonoccurrence of congenital yaws is the inability of treponema frambœsia permanently to localize and produce lesions in internal organs, and, in particular, to attack blood vessels.

His conclusion is that:

“Biologic differences in organotropism or tissue selectivity between the treponema of yaws and the treponema of syphilis are responsible for the difference between these two diseases with regard to their clinical course, severity of symptoms, heredity, and epidemiology.

“The two diseases belong to one group and show close relationship, but are fundamentally distinct.”

The force of much of Miyao's argument is lost when one considers the virulent strains of yaws, such as those existing in Haiti and which apparently do not exist in the Philippines. These virulent strains do not remain in the superficial skin layers; and clinical observations and autopsy material bear evidence that these strains are capable of producing any or all of the vascular and other lesions which Miyao claims can only be produced by syphilis.

Miyao's views are essentially those expressed in numerous earlier papers by Schöbl, who derived these views largely from his experimental work with Philippine monkeys. Thus the ideas of Schöbl and Miyao regarding the pathology of yaws do not necessarily represent the pathology found in man, nor do they represent the pathology produced by the more virulent strains of yaws.

Miyao's differential table (covering about six pages) is but one of scores of tables of this sort, published in the last 50 years, which have attempted to contrast supposed differences between these supposedly two different conditions.

Although a vast amount of experimental work and clinical observations have sought to clarify this problem in the last 30 years, the weight of the evidence at hand does not indicate that differences in the manifestations of the two conditions are due to the existence of two biologically distinct organisms, but rather that the same organism is operating under distinctly different conditions. Actually, these differences in manifestations are of such a nature that if they are to be explained on the basis of two distinct organisms, then it must be concluded that this difference in organisms is no greater than the difference existing between what are considered the different strains of organisms that produce the various pathological pictures we find in the disease we call syphilis.

BUREAU POLICY REGARDING FUMIGATION OF SHIPS

The most recent policy of the bureau in regard to the fumigation of ships is as follows:

Fumigation should be done in the case of diseases occurring on board in which vermin are the only or principal carriers of infection, as in plague, yellow fever, or typhus; or when, through neglect of cleanliness or routine vermin-eradication measures, the infestation becomes so overwhelming that an initial removal of vermin is necessary to make living conditions tolerable.

It must be pointed out that fumigation does not usually result in the destruction of the eggs of many insects and through the hatching of eggs, the arrival of drafts of men with infected clothing or bedding, and the contacts of men on liberty, the vessel is soon reinfested, unless constant efforts are made to prevent it. Consequently the problem is one of constant routine cleanliness, regular inspections, and the use of such insecticidal measures as heat, chemical solutions, and alterations to remove inaccessible places where vermin may breed undisturbed by these measures.

An effective fumigation involves considerable expense, the temporary removal of officers and men and their effects, and delay in ships' movements. Furthermore, the use for fumigation of certain highly poisonous gases such as hydrocyanic-acid gas requires a proper plant and trained teams to minimize the danger to workers. Where the establishments of the United States Public Health Service are not available for the fumigation of a ship with hydrocyanic-acid gas, fumigation should not be undertaken by naval personnel except for the most urgent reasons.

RECENT ADVANCES IN THE TREATMENT OF CIRCULATORY DISTURBANCES OF THE EXTREMITIES

In the November, 1930, number of the *Annals of Surgery*, Arthur W. Allen reports the results of experiences with 763 cases of varicose veins and peripheral arterial disturbances treated at the Massachusetts General Hospital during 1929 and 1930.

In varicose-vein injections the clinic found that repeated injections at intervals gave better results than single massive injections and that the solution preferred was that of quinine and urethane.

Below is a table of differential diagnoses based on 194 cases of arterial disturbances.

	Vasomotor disturbances	Thrombo-angitis obliterans	Mönckeberg's arteriosclerosis	Senile arteriosclerosis
Average age.....	30.....	40.....	50.....	60.....
Sex.....	Female.....	Male.....	Male.....	Both.....
Nationality.....	All.....	Hebrew.....	All.....	All.....
Duration of symptoms.....	Years.....	Years.....	Months.....	Months.....
Extremity.....	Upper.....	Lower.....	Lower.....	Lower.....
Symmetry.....	Bilateral.....	One side at a time.....	Unilateral.....	Unilateral.....
Gangrene.....	Late.....	Late.....	Early.....	Early.....
Pulsating vessels.....	Normal.....	None.....	None.....	Faint or none.....
Vessels by X ray.....	No.....	No.....	No.....	Yes.....
Response to foreign protein.....	Marked.....	Marked.....	Slight.....	Slight.....
Response to novocaine block.....	Rapid and marked.....	Slow and mild.....	To be determined.....	Do.....
Development collateral circulation.....	None.....	Good.....	Slight.....	Fair.....

Below is a composite table showing the results of 41 patients treated by nonspecific foreign protein only. No other patients in this group have come to major amputations but three cases of thrombo-angitis obliterans have returned with the disease in other extremities. These have also responded to treatment.

	Vaso- motor disease (Raynaud)	Thrombo- angitis obliterans	Arteri- osclerosis with and without diabetes	Total
Number of cases treated.....	10	24	7	41
Average age.....	25	40	60	—
Average duration symptoms (years).....	2.9	4.4	0.4	—
Number with complete disability.....	3	18	7	28
Minor amputation necessary.....	1	6	1	8
Major amputation necessary.....	0	3	4	7
Average number of treatments.....	3	9	8	—
Average duration of treatments (months).....	5	8	4	—
Improved.....	9	17	4	30
Not improved.....	1	7	3	11
Complete disability now including cases of major amputations (after treatment).....	1	6	4	11

Doctor Allen summarizes that—

“Cases with mild symptoms may carry on for an indefinite period by occasional advice in the out-patient department concerning rest, hygiene, care of the feet, proper protection with lamb’s wool and woolen stockings, and exercises to be done at home. A suitable ambulatory case of vasomotor disorder or thrombo-angiitis obliterans may spend 24 hours in the emergency ward occasionally, at which time a protein shock with typhoid vaccine intravenously may be given.

“Those cases of sufficient severity to cause complete disability, as well as those who need constant observation, are treated in the hospital. They are given any emergency attention necessary and are started on the routine measures of rest, heat, hygiene, fluids, food, and exercises. After stabilization, specific treatment is instituted according to the condition. Advancing infection is drained, and advancing lymphangitis amputated. Nonspecific foreign protein is tried in thrombo-angiitis obliterans, peripheral nerve alcohol injection in cases of intractable pain, and sympathetic ganglionectomy carried out in advanced vasomotor disorders.

“In chronic cases an individual time limit is set and if improvement is not evident in a given time (one to eight weeks, depending upon the condition and contributory factors), more radical measures are adopted. If a person with a hopeless extremity which has remained at a standstill or definitely grown worse in spite of treatment, refuses amputation, then through the social service proper disposal is arranged, with all the helpful advice for comfort that we can give them.”

DIAGNOSIS OF TUMORS INVOLVING SPINAL CORD

Henry W. Woltman, Rochester, Minn. (Journal A. M. A., November 8, 1930), stresses the fact that the patient’s story is the most important step in diagnosis. The earliest and commonest complaint is

pain. The pain may be in the spine at the site of the tumor; it may be referred to the lower extremities even when the tumor lies high in the canal, but usually it is referred along the distribution of a posterior root, when it is known as a root pain. Root pains have certain characteristics. They are segmentally distributed; that is, lengthwise in the arms and legs and circularly in the trunk. Then, since tumors grow, the pain becomes more and more intense and adjacent roots become involved; unilateral sciatica becomes bilateral sciatica, and unilateral trunk pain has added to it a complementary pain on the opposite side, completing the so-called girdle. Since there are usually no diseased organs at the site of the pain, there is, as a rule, no local tenderness. Coughing, sneezing, compression of the jugular veins, or, in short, anything which suddenly increases the pressure of the spinal fluid aggravates the pain. Root pains have a habit of awakening the patient from sleep at 3 or 4 o'clock in the morning. He discovers that relief may be obtained by walking or by sleeping in a chair. In both of these positions the spine becomes relatively shorter. A helpful test consists in flexing the head sharply on the thorax; this simple maneuver often elicits or accentuates the pain. The explanation is probably to be sought in the resulting traction on the cord and dura and in the increased congestion within the head which displaces the cerebral fluid into the spinal canal. A blue pencil, which Richard Bright referred to as "the most useful instrument of the physician," will be found helpful. It is important to know the precise site of the pain, which may be marked on the patient. The dates of its appearance and its radiation should be recorded. By and by the patient may become aware of clumsiness in running or of outright muscular weakness. As a rule, the weakness is slowly progressive. Inspection of the tips of the patient's shoes may show a decided difference in wearing. Some patients collapse suddenly, arise, and wonder why they fell; this often happens in case of dumb-bell-shaped tumors which lie partly within and partly without the spinal canal, and may be due to transitory compression of the cord. Other patients who become suddenly weak may have suffered from hemorrhage or softening of the cord incidental to the tumor. Subjective sensory disturbances appear sooner or later. Disturbances in the sphincteric and sexual spheres may add to the discomfort of the patient. Following spinal puncture, aggravation of all symptoms is common; a neurologic examination may then enable one to establish a level of disturbance with ease when it was impossible before. Woltman reports three cases in which tumors were found at different segmental and transverse situations. He discusses the hydrostatic and chemical changes of the spinal fluid, the value of roentgenography in diagnosis and the difficulty often encountered in arriving at a diagnosis. Repeated examinations may be necessary

in order to establish a diagnosis. Occasionally exploratory laminectomy is advisable, particularly if progressive involvement of the cord makes further delay perilous. However, exploration without definite indication of the correct level of disturbance is almost certain to result in disappointment.

INTRAVENOUS UROGRAPHY BY MEANS OF SODIUM SALT OF 5-iodo-2-PYRIDON-N-ACETIC ACID

Moses Swick, New York (Journal A. M. A., November 8, 1930), relates his experiences with the use of this contrast medium. He says that it is nontoxic, very soluble in water, and neutral in its reaction. The iodine in the molecule exists in a stable organically bound state. Neither in the injected solution nor in its excreted form is iodine present in ionized state. These facts, despite the relatively large quantity of iodine in the amount of this substance that can be administered with impunity, would seem to explain, at least empirically, why iodism has never been observed. The tolerance for this compound is exceedingly great. The substance is excreted as such through the urinary tract, being recovered from the urine as the light yellow, insoluble acid on the addition of a dilute mineral acid. It has been considered feasible to apply a quantitative determination of this insoluble, precipitated acid form as a basis for a test of renal function. The theory of this test is discussed in detail. The normally functioning kidney possesses the ability to excrete this substance in a relatively large quantity within a given short period. Therefore, to evaluate intravenous urography and to interpret correctly the results obtained from it, it is of paramount importance to consider this method as an excretory one and to bear constantly in mind the processes occurring in the renal and extrarenal systems. The method of administration, the reactions, application, and contraindications of this method are discussed.

Leopold Jaches, New York (Journal A. M. A., November 8, 1930), discusses the Röntgen technic of this method which is that usually employed in urinary-tract examinations. The method is indicated in all instances in which urography is desirable and is applicable in many more cases than the retrograde method, because the objections to instrumentation are eliminated. It has thus been possible to employ this method in children as young as 6 months and in adults with large prostates, cardiac disease, or other contraindications. Contraindications to the use of the intravenous method would be actual or latent uremia in which, as a result of the poor concentrating power of the kidney, meager or no anatomic information could be obtained. The advantages of the intravenous method are manifold. It intensifies the kidney shadows, frequently bringing out

irregularities in outline. Instrumentation is avoided which, even under favorable circumstances is, to say the least, very unpleasant and which seems to cause a temporary inhibition of function of the kidney subjected to it. The entire urinary tract, including the bladder, is shown at one application of the method. Anomalies in the urinary tract, such as double ureters, are revealed in some cases in which the cystoscopic method failed for technical reasons. It is not subject to failure in stricture of the ureter and is the only useful method in the study of the result of transplantation of ureters. It eliminates the artefacts which not infrequently complicate the other method and sometimes make one hesitate to designate a transparency within the opaque material as a calculus rather than an air bubble or to say that a defective calix is due to a pathologic lesion and not to poor injection technic, especially when the urologist happened to be one of limited experience. An added advantage of this method is that it demonstrates not only the anatomy of the urinary tract but also its function.

THE CAUSE OF GINGER PARALYSIS DEFINITELY IDENTIFIED

The cause of ginger paralysis has been determined. This paralysis, which has afflicted thousands of victims, is not caused by ginger at all but by a compound known to chemists as tri-ortho cresyl phosphate. This chemical is the main constituent of technical tricresyl phosphate, which is widely used in trade circles, especially in the manufacture of varnishes, shellacs, and similar preparations. Being cheap and readily obtained in any quantities, it appears to have been used by irresponsible makers of so-called ginger extract to replace the ginger. There seems to be no question that the adulterated paralytic ginger extract contained tri-ortho cresyl phosphate in an approximate concentration of about 2 per cent.

The United States Public Health Service has been working on the public health aspects of "Jake paralysis" since the wide appearance of this condition in certain sections of the country last winter and spring. In attacking the problem, it soon became evident to investigators that they were dealing with a new form of paralysis and one in which many possibilities were involved. As the investigations proceeded, it became evident that some form of phenol was the causative agent. Soon attention was centered on technical tricresyl phosphate. Chemists of the Prohibition Bureau had found similar substances in suspected extracts. As a number of different chemicals enter into the manufacture of this commercial product, it became necessary to separate them and find out what effect each might have if used in a beverage. This has been done, and it has

been found that tri-ortho cresyl phosphate, either itself or in combination with other chemicals of harmless nature, when given to various kinds of animals will produce exactly the same kind of paralysis as that caused by drinking of "Jake." The Public Health Service has no record of a single case of paralysis caused by ginger preparations manufactured by reputable pharmaceutical concerns. Tri-ortho cresyl phosphate is therefore definitely established as the specific cause of the cases of so-called "ginger paralysis."

Studies conducted on laboratory animals show conclusively that a paralysis of the extremities can be produced uniformly in monkeys and other animals by the injection under the skin or by oral administration of the chemically pure as well as the technical tri-ortho cresyl phosphate. The failure to produce any symptoms whatever in monkeys with enormous doses of this poison given by mouth indicates that it is practically not absorbed from the intestinal canal in that species.

The precise reason for including this remarkable substance as one of the ingredients of a substandard fluid extract of ginger made and sold for beverage purposes will probably never be known, unless a confession is wrung from the guilty ones. It seems entirely reasonable, however, to suppose that it was included on account of its physical or other properties which make it difficult to distinguish from the normal ginger constituents. Only a chemist of considerable ability could have thought of this; and had there been anything known about the pharmacologic action of this substance and the possible dire consequences, it is probable that it would never have happened. From this the question naturally arises as to whether there are not many other organic compounds of great medicinal interest, perhaps some with great possibilities for the treatment of disease, awaiting the attention of investigators.

The autopsy reports of three patients with Jamaica ginger paralysis dying of other causes are presented by Raymond H. Goodale and Margaret B. Humphreys, Worcester, Mass. (*Journal A. M. A.*, January 3, 1931). A study of the nerves shows an acute inflammation of one segment of the cauda equina in one case and myelin sheath and axis cylinder degeneration of the radial, sciatic, external popliteal, anterior tibial, and posterior tibial nerves in all three cases. The degeneration is found as high as the gluteal fold in the sciatic nerve, but not in the anterior roots of the lumbar cord. These observations are consistent with the observations in a follow-up clinic, in which it was found that all patients showed marked improvement of wrist and finger motion and little or no improvement of foot motion from five to six months after the onset of paralysis.

HEALTH CONDITIONS IN THE UNITED STATES

In a report recently made public by the United States Public Health Service Surg. Gen. H. S. Cumming points out that for the past fiscal year health conditions throughout the United States were generally good, with the exception of certain diseases. The prevalence of influenza and pneumonia was comparatively low during the year, and there were comparatively few deaths from these conditions.

Yellow fever did not appear in the United States or its possessions during the year. Gratifying progress has been made in the control of this disease, which has not appeared in epidemic form in the United States since 1905, but the presence of yellow fever in Brazil and Colombia in South America during the year showed that its introduction into the United States is possible, and the mosquito which spreads the disease is known to abound in certain areas in this country.

Plague-infected rodents were found in the State of California, but no human cases were found in the United States or its possessions. Cases are likely to occur, however, as long as the infection exists in rodents. Plague was reported in many of the ports with which the United States has commerce. It was present during the year in all the grand divisions of the world, with the exception of Australia.

Preliminary figures show a decrease in both the birth and death rate as compared with the preceding year. This is a continuation of the trend which has been noted in the statistics for most civilized countries for several decades.

In 1928 there was an increase in the incidence of malaria. This disease has been disappearing from many parts of the United States where it was once prevalent. For 1929 the reports from 45 States showed a slight decrease in malaria deaths from the high figures of 1928, but in some of the southern States, where malaria is a serious problem, the reports of cases and deaths show increased prevalence in 1929 as compared with 1928.

The case and death rates for diphtheria have been decreasing for many years, and in the calendar year 1929 these rates reached new low records. Forty-five States reported 71.4 cases of diphtheria and 6.6 deaths per 100,000 population. Ten years ago, in 1919, 37 States reported 137 cases of diphtheria per 100,000 population and the diphtheria death rate in 32 States was 13 per 100,000. These were low rates at that time, but the 1929 rates are nearly 50 per cent lower. There is no doubt that the use of antitoxin and immunization against diphtheria has contributed to the remarkable decline in the number

of diphtheria cases and deaths. If these agencies had been more generally used, the improvement would have been greater.

The incidence of meningococcus meningitis has steadily increased since 1924 to the winter of 1930. But in the spring of 1930 the number of cases dropped below the figures for 1929.

The prevalence of pellagra has been increasing for several years. In 1924 the pellagra death rate computed from reports to the Public Health Service was 2.5 per 100,000 population. The rate rose steadily until 1928, when it was 5.7 per 100,000 (based on reports from 45 States). For the calendar year 1929 the pellagra death rate was 5.5 per 100,000 population.

During the calendar year 1929 the incidence of infantile paralysis was lower than it had been since 1926, but by the end of June, 1930, there was a marked increase in the number of cases reported. Reports of unusual prevalence of this condition were received from communities in widely separated parts of the United States. This disease normally reaches its greatest incidence in this country in the late summer and early fall.

For three years, at least, the incidence of smallpox in the United States has been increasing. Forty-five States reported 34,685 cases of smallpox in 1927, 38,114 cases in 1928, and 41,458 cases in 1929. The disease was of the mild type and in the 45 States only 442 deaths were recorded during the three years; yet the 114,000 cases of smallpox represent an incalculable amount of suffering and a large economic loss to the country, all of which could have been avoided by vaccination and revaccination. One danger in smallpox lies in the fact that the virulent type of the disease may appear at any time in a community not protected by vaccination, and before the disease can be checked it may take many lives.

Low records were also reported during the year 1929 for tuberculosis and typhoid fever.

Nine hundred and seventy-five cases of undulant (Malta) fever were reported to the Public Health Service for the calendar year 1929, with 41 deaths. The importance of undulant fever becomes more apparent as more is learned of the disease.

Tularemia is much more widespread than it was thought to be when the disease was discovered. The reports are not complete, but, in 1929, 461 cases and 36 deaths were reported to the Public Health Service.

The mild type of typhus fever, which differs in some respects from the Old World typhus and from the form of typhus which is endemic in Mexico, was reported during the year 1929 in a number of States, especially in the southeastern part of the United States. Incomplete reports showed 239 cases of typhus fever and 16 deaths from this disease in 18 States during 1929.

PRINCIPAL CAUSES OF DEATH IN THE REGISTRATION AREA: 1929

WASHINGTON, D. C., October 29, 1930.—The Department of Commerce announces that 1,386,363 deaths occurred in 1929 in the registration area in continental United States, corresponding to a rate of 11.9 per 1,000 population, as compared with 12.1 in 1928.

This area in 1929 comprised 46 States, the District of Columbia, and 9 cities in nonregistration States, with an estimated population on July 1, 1929, of 116,275,139, or 95.7 per cent of the total population; in 1928 the registration area included 95.3 per cent of the total population.

The death rate from all causes per 100,000 population decreased from 1,207.1 in 1928 to 1,192.3 in 1929. This net decrease was almost entirely balanced by increases in influenza (from 45.3 to 55.5), diseases of the heart (208.3 to 210.9), and meningococcus meningitis (2.6 to 4.5). Deaths from these three diseases alone caused 21.2 per cent of all deaths in 1928 and 22.7 per cent in 1929.

Among the epidemic and endemic diseases listed in this summary, 7 showed lower rates in 1929 than in 1928, the outstanding one being for measles (5.4 to 2.5), which caused less than half as many deaths in 1929. Decreases were shown also for typhoid and paratyphoid fever, diphtheria, acute anterior poliomyelitis, dysentery, lethargic encephalitis, and malaria. Other epidemic and endemic diseases showed increased rates, among them whooping cough, scarlet fever, and erysipelas.

Decreases among other important causes were for pneumonia, all forms (from 98.2 in 1928 to 91.7 in 1929), nephritis (95.3 to 91.2), congenital malformations and diseases of early infancy (65.8 to 62.4), tuberculosis, all forms (79.4 to 76), diarrhea and enteritis, under 2 years (20.7 to 17.9), diabetes mellitus (19 to 18.8), cancer (96.1 to 96), and pellagra (6.1 to 5.8). Deaths from alcoholism decreased from a rate of 4.1 in 1928 to 3.7 in 1929.

Deaths from accidental and unspecified external causes increased from 79.4 to 80.9. The types of accidents which showed the most noticeable increases were automobile accidents, excluding collisions with railroad trains and street cars (20.8 to 23.3), and accidental falls (14.1 to 14.6). A slight decrease was shown for deaths from drowning (7.1 to 6.2).

Cause of death	Deaths in the registration area in continental United States			
	Number		Rate per 100,000 estimated population	
	1929	1928	1929	1928
All causes ¹	1,386,363	1,378,675	1,192.3	1,207.1
Typhoid and paratyphoid fever.....	4,854	5,620	4.2	4.9
Malaria.....	4,084	4,167	3.5	3.6
Smallpox.....	151	131	.1	.1
Measles.....	2,923	6,146	2.5	5.4
Scarlet fever.....	2,468	2,229	2.1	2.0
Whooping cough.....	7,310	6,234	6.3	5.5
Diphtheria.....	7,685	8,263	6.6	7.2
Influenza.....	64,583	51,741	55.5	45.3
Dysentery.....	2,777	3,215	2.4	2.8
Erysipelas.....	2,887	2,724	2.5	2.4
Acute anterior poliomyelitis.....	812	1,381	.7	1.2
Lethargic encephalitis.....	1,313	1,373	1.1	1.2
Meningococcus meningitis.....	5,208	2,923	4.5	2.6
Tuberculosis (all forms).....	88,352	90,659	76.0	79.4
Of the respiratory system.....	78,624	80,285	67.6	70.3
Of the meninges, central nervous system.....	3,114	3,446	2.7	3.0
Other forms.....	6,614	6,928	5.7	6.1
Syphilis ²	16,188	16,826	13.9	14.7
Cancer and other malignant tumors.....	111,569	109,770	96.0	96.1
Of the buccal cavity.....	3,538	3,555	3.0	3.1
Of the stomach, liver.....	37,915	38,128	32.6	33.4
Of the peritoneum, intestines, rectum.....	16,961	16,130	14.6	14.1
Of the female genital organs.....	15,944	15,839	13.7	13.9
Of the breast.....	10,204	10,056	8.8	8.8
Of the skin.....	2,934	3,020	2.5	2.6
Of other or unspecified organs.....	24,073	23,042	20.7	20.2
Rheumatism.....	4,401	4,324	3.8	3.8
Pellagra.....	6,793	6,969	5.8	6.1
Diabetes mellitus.....	21,829	21,747	18.8	19.0
Pernicious anemia.....	3,608	3,608	3.1	3.2
Alcoholism (acute or chronic).....	4,339	4,627	3.7	4.1
Meningitis (non-epidemic).....	3,594	3,287	3.1	2.9
Cerebral hemorrhage and softening.....	100,061	99,624	86.1	87.2
Paralysis without specified cause.....	5,532	5,827	4.8	5.1
Diseases of the heart.....	245,244	237,849	210.9	208.3
Diseases of the arteries, atheroma, aneurysm, etc.....	25,506	25,112	21.9	22.0
Bronchitis.....	5,470	5,975	4.7	5.2
Pneumonia (all forms).....	106,597	112,195	91.7	98.2
Respiratory diseases other than bronchitis and pneumonia (all forms).....	9,635	9,969	8.3	8.7
Ulcer of the stomach and duodenum.....	7,428	7,329	6.4	6.4
Diarrhea and enteritis.....	27,357	30,730	23.5	26.9
Diarrhea and enteritis (under 2 years).....	20,788	23,663	17.9	20.7
Diarrhea and enteritis (2 years and over).....	6,569	7,067	5.6	6.2
Appendicitis and typhlitis.....	17,687	17,433	15.2	15.3
Hernia, intestinal obstruction.....	12,283	11,954	10.6	10.5
Cirrhosis of the liver.....	8,377	8,630	7.2	7.6
Nephritis.....	106,056	108,813	91.2	95.3
Puerperal septicemia.....	5,822	5,692	5.0	5.0
Puerperal causes other than puerperal septicemia.....	9,496	9,999	8.2	8.8
Congenital malformations and diseases of early infancy.....	72,559	75,159	62.4	65.8
Suicide.....	16,260	15,566	14.0	13.6
Homicide.....	9,909	10,050	8.5	8.8
Accidental and unspecified external causes.....	94,033	90,712	80.9	79.4
Burns (conflagration excepted).....	6,168	6,323	5.3	5.5
Accidental drowning.....	7,252	8,084	6.2	7.1
Accidental shooting.....	3,015	2,839	2.6	2.5
Accidental falls.....	16,919	16,116	14.6	14.1
Mine accidents.....	2,661	2,639	2.3	2.3
Machinery accidents.....	2,281	2,180	2.0	1.9
Railroad accidents.....	6,769	6,796	5.8	6.0
Collision with automobile.....	1,958	2,041	1.7	1.8
Other railroad accidents.....	4,811	4,755	4.1	4.2
Street-car accidents.....	1,439	1,581	1.2	1.4
Collision with automobile.....	507	542	.4	.5
Other street-car accidents.....	932	1,039	.8	.9
Automobile accidents (excluding collision with railroad trains and street cars).....	27,066	23,765	23.3	20.8

¹ Exclusive of stillbirths.

² Includes tabes dorsalis (locomotor ataxia) and general paralysis of the insane.

Cause of death	Deaths in the registration area in continental United States			
	Number		Rate per 100,000 estimated population	
	1929	1928	1929	1928
Accidental and unspecified external causes—Continued.				
Injuries by vehicles other than railroad trains, street cars, and automobiles ¹	1,910	1,819	1.6	1.6
Excessive heat (burns excepted).....	500	654	.4	.6
Other external causes.....	18,053	17,916	15.5	15.7
All other defined causes.....	109,065	108,533	93.8	95.0
Unknown or ill-defined causes.....	24,258	23,560	20.9	20.6

¹ Includes airplane, balloon, and motor-cycle accidents.

NOTE.—Rates in this summary are based upon revised estimates of population, derived from the 1920 and 1930 censuses, and it will be seen that the rates shown for 1928 vary only slightly from those previously published, which were based on estimates projected from the 1910 and 1920 censuses.

THIRD INTERNATIONAL CONGRESS OF RADIOLOGY

The Third International Congress of Radiology will be held in Paris, July 26–31, 1931.

Naval medical officers who may find occasion to be in Paris at that time are cordially invited to attend.

Much of the time of the congress will be spent on the study of the cancer problem and on the agencies concerned with the energy of radiation in medicine and surgery.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

INTRODUCTION TO MEDICAL BIOMETRY AND STATISTICS, by *Raymond Pearl*, Professor of Biology in the School of Hygiene and Public Health, and in the Medical School, the Johns Hopkins University. Second edition. W. B. Saunders Co., Philadelphia, 1930

To research workers, statisticians, compilers of data—either medical men or biologists—this book will serve as an enormous aid in bringing an understanding of the quantitative methods and mathematical procedures which are indispensable parts of biometric studies.

It is rather an introduction to the subject and an exposition of the basic elements of the subject than an exhaustive treatise.

Among the 92 illustrations will be found excellent portraits of Francis Galton, Karl Pearson, A. Udny Yule, and other great contributors to our knowledge of biometrics.

The chapter on the history of vital statistics makes fascinating reading; and the entire book, besides being extremely readable, will be found a constant and high source of help to all those who wish to engage in any work involving statistical methods.

NOSOGRAPHY, THE EVOLUTION OF CLINICAL MEDICINE IN MODERN TIMES, by *Knud Faber*, M. D., LL. D., Professor of Internal Medicine, University of Copenhagen. Second edition. Paul B. Hoeber, New York, 1930. Price, \$3.75.

This is a series of lectures on the history of internal medicine or rather that particular field of it which deals with the description of disease. The two definite schools of thought in internal medicine are outlined. One school, of which Sydenham, Laënnec, Stokes, and Bright are the leading names, is concerned with the descriptions of

a disease as simply the reaction of the individual to a specific etiologic factor. This is contrasted with the school of Hippocrates and the Modern German teachers, such as Wunderlich and Traube, in which each clinical case is dealt with as an entity in itself and the idea of general classes of disease is made of secondary importance. The profound effect of Pasteur's and Koch's discoveries of specific causes of the infectious class of diseases is very graphically told. The discussion of importance of functional diagnosis and the evolution of the conception of functional disease is also admirable. The book is well printed, handsomely bound, and illustrated with a series of fine portraits of such men as Sydenham, Linne, Laënnec, Bright, Virchow, Pasteur, Koch, Ehrlich, and Widal.

WARREN'S HANDBOOK OF ANATOMY, From original dissections by *John Warren, M. D., Late Associate Professor of Anatomy, Harvard Medical School*. Text by *Robert M. Green, M. D., Assistant Professor of Applied Anatomy, Harvard Medical School*. Harvard University Press, Cambridge, 1930.

This reviewer is at quite a loss to find the words that will convey the idea of the point of superlative excellence that this book has reached in anatomical art, in the teaching value of the dissections portrayed, and in its descriptive matter. It surpasses Spalteholz in many respects. There are 324 illustrations of the dissections. In all conservatism and fairness an examination of the book impels the reviewer to the conclusion that the book should be rated well in front of all the one-volume atlases that have yet been produced.

RECENT ADVANCES IN HÆMATOLOGY, by *A. Piney, M. D., Ch. B. (Birm.) ; M. R. C. P. (Lond.), Hæmatologist, Cancer Hospital, London, etc.* Third edition. P. Blakiston's Son & Co., Philadelphia, 1931.

The fact that this book is now in its third edition since 1927 and that a Spanish edition was published in 1928 is not difficult to understand after one looks into its contents.

In a compact little book of some 350 pages the author has included precisely the information desired by laboratory workers and by clinicians who are especially interested in hæmatology.

The book is extremely readable and the subject is presented in all its up-to-the-minute aspects. To quote from the introduction,

"As a purely descriptive science, hæmatology seems to present no immediate possibility of striking advance unless new technical methods are elaborated, but the possibility of experiment is practically endless, because almost every conceivable manipulation results in more or less important changes in the circulating blood and, therefore, in the hæmatopoietic tissues. It must be realized that the practical exhaustion of one aspect of hæmatological work does not, in any way, imply that the cultivation of the subject from a

slightly different aspect does not offer the chance of well-marked advance. There is now a great body of facts available, and the task before us is the attempt to weld the isolated data into a comprehensible whole."

The chapters embrace the following:

The Reticulo-endothelial System; The Development of the Blood Cells; "Leukaemia"; Pernicious Anæmia; Some Anæmias with Low Colour Index; Sick Cell Anæmia; Leukæmoid Blood Pictures.—I. Infective; Leukæmoid Blood Pictures.—II. Noninfective; Reticulo-endotheliosis; "Polycythæmia"; "Hæmorrhagic Diatheses"; Symptomatic Blood Changes; Splenomegaly.—I. The Spleen in Various Infections; Splenomegaly.—II. Gaucher's Diseases; Splenomegaly.—III. Banti's Disease; Splenomegaly.—IV. Acholuric Jaundice; Splenomegaly.—V. Anæmia Pseudo-Leukæmica Infantum; Summary; Appendix I. Hæmatological Technique and Appendix II. Glossary.

The colored plates are excellent and it is hoped that there will be more of these in future editions.

MICROBIOLOGY AND ELEMENTARY PATHOLOGY, by *Charles G. Sinclair, B. S., M. D., Major, Medical Corps, U. S. Army; Instructor in Bacteriology, Army Medical School; Instructor in Microbiology and Pathology, Army School of Nursing, Washington, D. C.* F. A. Davis Co., Philadelphia, 1931. Price, \$2.50.

Major Sinclair has written what appears to be an admirable elementary book on bacteriology and pathology. Intended primarily for use in nursing schools, it is an excellent brief survey of bacteriology, parasitology, immunology, and pathology. It is of convenient size, well printed and with numerous and remarkably fine pictures. An interesting feature is a brief outline of the history of the subject with portraits of Pasteur, Koch, Lister, and Welch, and a reproduction of one of Leeuwenhoek's microscopes.

PIERSOL'S HUMAN ANATOMY, under the supervision of *G. Carl Huber, M. D., Sc. D., Professor of Anatomy, Director of Anatomic Laboratories and Dean of the Graduate School, University of Michigan.* Ninth edition. J. B. Lippincott Co., Philadelphia. Price, \$10.

This ninth edition of Piersol's was revised by Professor Huber with the assistance of a number of collaborators. This standard text is so well known as to require little more than mention. The particularly fine feature of this textbook, the extensive histological and embryological sections, and the practical relation of the anatomy with diagnosis and treatment are preserved in the new edition.

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RECENT ADVANCES IN THE STUDY OF RHEUMATISM, by *Frederio John Poynton*, M. D., F. R. C. P. (Lond.), *Physician, University College Hospital; Senior Physician, Hospital for Sick Children, Great Ormond Street, and Bernard Schlesinger*, M. A., M. D. (Camb.), M. R. C. P. (Lond.), *Physician to the Children's Department, Royal Northern Hospital, etc.* P. Blakiston's Son & Co., Philadelphia, 1931.

A very useful monograph in which the subject is treated largely from the clinical and practical angle, and thus is of distinct value to the practitioner who frequently faces the problem of treating patients suffering from acute or chronic rheumatism.

As suggested by the title, much attention is devoted to the more recent advances in this field.

INTERNAL MEDICINE, by *Humphry Rolleston, Bart., Regius Professor of Physics in the University of Cambridge, England.* Paul B. Hoeber, New York. Price, \$1.50.

This is one of a number of little volumes dealing with a particular subject or field of medical history. As the history of internal medicine is essentially the history of the whole science, the brief space allowed is pretty well packed with names and dates. This has made it somewhat difficult to give emphasis to the important figures and events, but the author had undoubtedly kept this difficulty in mind and has succeeded in bringing out certain high spots such as the influence of Hippocrates in assembling the medical knowledge of his time, the importance of Jewish and Arabian medicine as carriers of Greek and Latin medicine to the western world through contacts during the Crusades, the Mohammedan conquests in Southern Europe, and the establishment and influence of the great medieval universities, Bologna, Paris, Oxford, Cambridge, Padua, and Montpellier.

The rise of preventive medicine, tropical medicine, experimental pharmacology, industrial medicine and the tremendous influence that anesthesia, modern bacteriology, parasitology, and the use of statistical methods have had on the medical world make up the latter chapters of this useful little manual.

CHRONIC ARTHRITIS AND RHEUMATOID AFFECTIONS WITH RECOVERY RECORD, by *Bernard Langdon Wyatt*, M. D., F. A. C. P., *Director, The Wyatt Clinic; Member Editorial Staff of "Acta Rheumatologica" of the International League Against Rheumatism; etc.* William Wood & Co., New York, 1930. Price, \$2.50.

Both the author and the writer of the foreword plead that the profession give more recognition to the importance of rheumatism as a community health problem. They both believe that great advances

have been made in treatment in recent years and that the profession should make greater use of these advances.

The concept of Pemberton is emphasized: "The joint conditions are only one branch of a very large tree and constitute merely the expression on the surface of an underlying diseased state."

Dr. Louis I. Dublin and Mr. H. H. Marks have contributed an illuminating chapter on the incidence of rheumatic diseases.

The other chapters are:

Types and Causes; Preventive Measures; Early Diagnosis; Diet; Drugs, Vaccines, Nonspecific Proteins; Hydrotherapy, Colonic Lavage, Electric Currents, Radiant Heat; Joint Exercises, Joint Movements, Massage; Climate, Sun Baths; Orthopedic Measures, Surgical Treatment; Summary and Results.

OPERATIVE GYNECOLOGY, by *Harry Sturgeon Crossen, M. D., F. A. C. S., Professor of Clinical Gynecology, Washington University School of Medicine, and Gynecologist in Chief to the Barnes Hospital and the Washington University Dispensary, etc., and Robert James Crossen, M. D., Instructor in Clinical Gynecology and Obstetrics, Washington University School of Medicine.* Fourth edition. The C. V. Mosby Co., St. Louis, 1930. Price, \$15.00.

Doctor Crossen's Fourth Edition of Operative Gynecology is profusely illustrated, there being 400 new and numerous modifications of older illustrations. Preoperative examination and preparation of the patient, as well as after care is stressed. Detailed technique of operations is given, and, where several well-known methods are recognized, the technique of each is described. There are chapters on "Abdominal Section Preparation"; "Abdominal Section Technique"; "After Treatment in Abdominal Section," giving the day-by-day after treatment as well as treatment by special conditions that may arise; "Vaginal Operations," and "Anesthesia" and "Medico-legal Points."

PHYSICAL DIAGNOSIS, by *Warren P. Elmer, B. S., M. D., Associate Professor of Clinical Medicine, Washington University, School of Medicine, St. Louis, etc., and W. D. Rose, M. D., Late Associate Professor of Medicine in the University of Arkansas, Little Rock, Arkansas.* The C. V. Mosby Co., St. Louis, 1930. Price, \$10.

This volume treats of the work covered in a course on the method of physical examination given at Washington University. Part 1 is devoted to the technique of physical examination of the normal subject; Part 2 is given over to physical diagnosis of disease. The subject matter is treated in detail and the illustrations are excellent. The aid of the electrocardiograph and X ray in diagnosis is used where applicable throughout the volume. In addition there is a good general chapter on the X ray as a diagnostic aid.

A **MANUAL OF NORMAL PHYSICAL SIGNS**, by *Wyndham B. Blanton, B. A., M. A., M. D., Richmond, Virginia, Assistant Professor in Medicine, Medical College of Virginia.* Second Edition. The C. V. Mosby Co., St. Louis, 1930. Price, \$3.

A very creditable little compend on physical examination and normal physical signs. It is written in notebook style, is sensible, practical, condensed, and should be found useful by the practicing physician although it is designed as an aid for students.

MEDICAL JURISPRUDENCE, by *Elmer D. Brothers, B. S., LL. B., Member of the Chicago Bar; Lecturer Emeritus on Jurisprudence in the Medical and Dental Departments of the University of Illinois, and Lecturer on Medical and Dental Jurisprudence in John Marshall Law School and on Historical Development of the Federal Constitution.* Third edition. The C. V. Mosby Co., St. Louis, 1930. Price \$3.50.

This is a well-arranged statement of the law of forensic medicine, written by an able and distinguished lawyer.

The text is well condensed and is clearly stated.

The book should be of great help to those physicians who perform court work, as it is an excellent guide as well as reliable reference.

LEGAL MEDICINE AND TOXICOLOGY, by *Ralph W. Webster, M. D., Ph. D., Clinical professor of Medicine (Medical Jurisprudence) in Rush Medical College, University of Chicago; etc.* W. B. Saunders Co., Philadelphia, 1930.

This work is designed to meet the need for a single volume on medical jurisprudence that will include the more important points and furnish information likely to be useful to the general practitioner. No attempt has been made to cover the subject in an absolutely exhaustive manner. However, Part II, dealing with toxicology, is very complete. The preliminary chapter to this part on the "General Principles of Toxicology" is a particularly fine introduction to this subject. The study of methyl alcohol poisoning and the section on alcoholism and the courts will be of value to medical officers who are called upon to appear before courts-martial to give testimony about such cases. Another feature of great importance is the careful description of the signs of death and of the methods of identification of the living and the dead.

The book in general is distinguished by its clear and concise treatment of the whole subject, yet with sufficient detail in the sections mentioned to make it a valuable reference work for cases with which a medical officer is likely to be confronted.

A **TEXT-BOOK OF PRACTICAL THERAPEUTICS**, by *Hobart A. Hare, B. Sc., M. D., LL. D., Professor of Therapeutics, Materia Medica, and Diagnosis in the Jefferson Medical College of Philadelphia, One-Time Commander, M. C., U. S. N. R. F.* Twenty-first edition. Lea & Febiger, Philadelphia, 1930. Price, \$7.50.

The fact that this is the twenty-first edition is sufficient evidence of the merits of this well-known textbook. The busy student and

practitioner who wants to know what drug to give, what preparation and dosage, and the method of administration, without being compelled to search through a vast mass of detail, is likely to find it at once in this practical therapeutics. Some of the features added to the new edition are the uses of calcium salts in tetany and dropsy, the intravenous use of tartar emetic in chancroid, the value of the various bismuth preparations in the treatment of syphilis, carbon dioxide in general anesthesia and hiccough, the deleterious effects of the prolonged use of cinchophen on the liver, the results of Kamm's work on the active principle of the posterior lobe of the pituitary, viosterol in rickets, and the intraspinal use of procaine.

EMERGENCY SURGERY, by *Hamilton Bailey, F. R. C. S. (Eng.)*, *Late Surgeon, Dudley Road Hospital, Birmingham, Assistant Surgeon, Liverpool Royal Infirmary; and Surgical Registrar, London Hospital*. Volume I. William Wood & Co., New York, 1930. Price, \$8.

A volume of distinct value to the surgeon as well as to the surgical interne or student. This volume is devoted to the acute surgical conditions of the abdomen and genitourinary system. It contains 324 excellent illustrations. In writing this first volume the author kept in mind "a patient stricken with an acute abdominal catastrophe and a comparatively isolated surgeon called upon to carry out appropriate treatment."

Volume II, which is nearing completion, will deal with the surgical emergencies of the head, neck, spine, thorax, and extremities.

HISTORIC ARTIFICIAL LIMBS, by *Vittorio Putti, M. D., Professor of Orthopedic Surgery, University of Bologna*. Paul B. Hoeber (Inc.), New York, 1930. Price, \$1.50.

This little book represents an admirable piece of research in compiling information on the subject of artificial limbs and the development of the art beginning with the fifteenth century.

Some of these limbs were built for function, others for esthetic purposes. The first successful hand and forearm was the famous Alt-Ruppin hand made about 1400.

It was natural that armorers had much to do with the manufacture of these limbs because one found already solved in armor the problems of mechanics and other details that were easily copied.

The book contains several excellent descriptions of ancient artificial limbs, including that immortalized by Goethe in his *Goetz von Verlichingen*.

PRACTICAL TREATISE ON DISEASES OF THE DIGESTIVE SYSTEM, by *L. Winfield Kohn, M. D., F. A. C. P., Formerly Assistant in the Gastro-intestinal Clinic, Johns Hopkins Hospital, Baltimore; Chief of the Clinic of Gastro-enterology, Medico-Chirurgical College, Philadelphia, etc.* Volumes I and II. F. A. Davis Co., Philadelphia, 1930.

This is a two-volume set amounting to a complete system on diseases of the digestive system. It covers some 1,100 pages.

It follows the usual pattern of such systems and is especially valuable as a reference. It would make a valuable up-to-date addition to any library that wishes to include an exhaustive reference on gastro-enterology.

A SYNOPSIS OF MEDICINE by *Henry Letheby Tidy, M. A., M. D., B. Ch. (Oxon.), F. R. C. P. (Lond.), Physician to St. Thomas Hospital; Consulting Physician to the Royal Northern Hospital, etc.* Fifth edition. William Wood & Co., New York, 1930. Price, \$6.

An excellent reference for students as well as a valuable teaching aid, amounting to an encyclopedic system of medicine condensed to a thousand pages. The fact that it has now reached its fifth edition attests the esteem in which it has been held by the profession.

INTESTINAL TOXEMIA, by *Anthony Bassler, M. D., F. A. C. P., Consulting Gastro-enterologist, St. Vincent's, People's and Jewish Memorial Hospitals, New York City; etc.* F. A. Davis Co., Philadelphia, 1930. Price, \$6.

This monograph is based on the treatment of 5,000 cases over a period of 30 years. Doctor Bassler is thus in a sound position to give a most mature judgment on this condition.

He has approached the subject from the biologic standpoint and seems to have almost exhausted every angle of it.

There are chapters of great length on the intestinal organisms and some interesting and valuable chapters on bacterial treatment, diabetic treatment, and on the related cardiology, neurology, and psychiatry, dermatology, urology, gynecology, and pediatrics.

By way of an appendix, the book contains several loose-leaf charts of the cultural characteristics of the intestinal organisms.

INTESTINAL TUBERCULOSIS, by *Lawrason Brown, M. D., Consultant to the Trudeau Sanatorium, Saranac Lake, New York, and Homer L. Sampson, Roentgenographer of the Trudeau Sanatorium, Saranac Lake, New York.* Second Edition. Lea & Febiger, Philadelphia, 1930. Price, \$4.75.

A book on this subject and by two such widely recognized authorities should be warmly received, both because the literature on the subject is all too meager and because it now seems well established that intestinal tuberculosis is the most common of all tuberculous complications.

The studies of the authors have led them to believe that "many patients, who otherwise might make a good recovery have been so

seriously handicapped by an unsuspected intestinal tuberculosis that they have lost all chance for recovery before diagnosis of this most insidious and most frequent complication was made."

The methods of examination are described in minute detail and the essentials of the diagnosis are summarized in a few pages, illustrated by diagrams and references given to plates.

The authors examined Roentgenologically 5,542 patients at the Trudeau Sanatorium and found 1,465 of this number to be suffering from intestinal tuberculosis. In all, some 40,000 examinations were made.

The book is a splendid monograph which should do much to stimulate interest in the closer study of intestinal tuberculosis and the methods of diagnosis and treatment.

SURGICAL CLINICS OF NORTH AMERICA, OCTOBER AND DECEMBER, 1930. W. B. Saunders Co., Philadelphia, 1930.

The October number is contributed by the Pacific Coast Surgical Association, composed of surgeons living in California, Oregon, Washington, British Columbia, and Hawaii. The clinics cover a wide range of subjects: 4 relating to surgical conditions of the lungs; 4 of the abdominal cavity; 4 of the kidney; 3 of aneurysms; 2 of fractures; 2 of the parotoid gland; 2 of the thyroid; 1 of the ear; 1 of the arteries; 2 of the brain; and 5 of miscellaneous subjects.

The December number is contributed by surgeons of Philadelphia, containing among other articles "A Clinical Lecture on Concer of the Rectum" by Dr. John B. Deaver; "Diverticulosis of the Esophagus, Coronary Air Embolism, Hyperextension of the Hand and Finger from a Burn," from the clinic of Drs. Chevalier Jackson and W. Wayne Babcock; "Chronic Empyema Treated by the Multiple Stage Method," from the clinic of Drs. John H. Jopson and Norman S. Rothschild; "So-called Subacromial Bursitis," from the clinic of Dr. John Berton Carnett; "Pathological Fractures," from the clinic of Drs. Eldridge L. Eliason and V. W. Murray Wright; "Splenectomy in Primary Pernicious Anemia," from the clinic of Dr. George P. Muller; "Intestinal Tumors," from the clinic of Drs. Edward J. Klopp and John W. Gibbon; "Complicated Fractures of the Mandible," from the clinic of Drs. Robert W. Joy and Lawrence Curtis; "The Management of Tumors of the Posterior Fossa by the Transtentorial Approach," from the clinic of Dr. Temple Fay; "The Value of and Indications for Encephalography and Ventriculography with Discussion of Technique," from the clinic of Dr. Eugene P. Pendergrass; "Fractures of the Tarsal Scaphoid and of the Os Calcis," from the clinic of Dr. Edward T. Crossan; "Three Common Surgical Diseases of the Rectum: Hemorrhoids, Prolapse of the Rectum in Children, and Fistula in Ano,"

from the clinic of Drs. Astley, P. C. Ashurst, and John W. Klopp; "Acute Suppurative Osteomyelitis," from the clinic of Dr. Thomas J. Ryan; "Experiences with the Use of Splanchnic and Spinal Anæsthesia for Upper Abdominal Operations. A Study of 150 Cases," from the clinic of Drs. L. Kraeer Ferguson and John Paul North.

HOW IT HAPPENED, by *Adalbert B. Bettman, M. D., F. A. C. S.* F. A. Davis Co., Philadelphia, 1931. Price, \$1.

A collection of short poems, arranged as an anthology. The poems deal particularly with thoughts that come to a doctor, a doctor who gets close to life and people.

The layman as well as physicians will be deeply impressed by some of these very real poems of very real life.

THE DIVISION OF PREVENTIVE MEDICINE

Capt. W. H. BELL, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

TUBERCULOSIS¹

PART IV

By M. A. STUART, Captain, Medical Corps, United States Navy

The general distribution of tuberculosis among human beings has long been recognized, but the frequency of tuberculous infection among those who have exhibited no evidence of tuberculosis was first demonstrated by Naegeli of Zurich in 1900. Regarding deaths from all causes, his statement that 97 per cent of those investigated showed at autopsy indications of unrecognized preexisting infection with the tubercle bacillus, was received at first with considerable skepticism, but subsequent investigations by others showed that adult inhabitants of European and American cities, with few exceptions, exhibit at autopsy either progressive tuberculosis, latent or quiescent tuberculosis, or the scars of an old infection. In regard to children, the studies of Ghon, based on a large number of observations, demonstrated the occurrence of healing and healed tuberculous lesions in the lungs and tracheobronchial lymph nodes. It has also been noted by many observers that the tuberculosis of children has the character of tuberculosis in a freshly infected animal, whereas reinfection of animals produces lesions with much closer resemblance to the phthisis of adults. The difference between the character of the disease in young children and in adults will be discussed later.

According to Opie (1), latent tuberculosis has long been known and its extensive distribution in the body fully recognized, but, while increased resistance, as the result of early infection, has been much discussed, the potential danger of concealed disease has been in large part overlooked. He defines "latent" tuberculosis as tuberculosis unaccompanied by significant symptoms or by physical signs. It is recognizable after death by the discovery of characteristic tuberculous lesions, and during life by the tuberculin test and by

¹ This is the last of a series of articles on tuberculosis, the first three parts of which appeared in the April, 1929, October, 1929, and October, 1930, numbers, respectively.

röntgenological examination. In many cases it is a trivial infection, and by increasing resistance it is beneficial, but in others it is a potential source of clinically manifest disease. It is said that the term implies that the disease is arrested, obsolescent, or healed, but with customary usage in regard to tuberculosis it means that the disease is hidden, concealed, not apparent, or manifested. It is accurately applied to lesions which are incipient and progressively active provided they are not manifest. A lesion which has the histological characters of early progressive tuberculosis, and contains living tubercle bacilli may be hidden or latent. Obviously, a disease, the activity of which is demonstrable by symptoms and physical signs, is manifest. There is, however, no sharp line of demarcation between latent tuberculosis and tuberculous disease.

Again, according to Opie, latent apical tuberculosis is found in adolescent children and seldom occurs before 12 years of age. The lesion, which may remain inactive for years or unsuspected during life, not infrequently develops into clinically manifest disease and is the forerunner of a large part of the tuberculosis of early adult life. It has been found in the lungs of one in every five or six individuals among 50 examined in St. Louis, Mo. These individuals had died with diseases other than tuberculosis and the lesion at the apex, often of considerable size, consisted of fibrous tissue surrounding caseous or calcified nodules. Among the relatively small number of individuals examined, the age incidence increased with advancing age, being 16.7 per cent between the ages of 18 and 30 years, 13 per cent between 30 and 50 years, 26.7 per cent between 50 and 70 years, and 50 per cent above 70 years. As with focal tuberculosis there is an increase in the incidence of tuberculous infection coincident with advancing age, but after the age of 30 or 35 years it pursues a fatal course less frequently.

Very extensive studies of the incidence of the tuberculin reaction have been made in children. According to Opie, Hamburger and Monti found that children under 1 year of age failed to exhibit a cutaneous reaction to tuberculin, whereas with increasing age the number of children who gave a positive reaction was rapidly augmented, and between the ages of 12 and 14 years represented 95 per cent of those examined. They reached the conclusion that this percentage of the population of Vienna was infected with tuberculosis before the age of 12 years. Von Pirquet found a smaller proportion, namely, 83 per cent, positive between the ages of 8 and 12 years, and observers in France and Italy have obtained similar figures.

In this country the incidence of the tuberculin reaction among children without signs or symptoms of manifest disease, has been lower than that found in European cities and is well represented by

the figures of Veeder and Johnson obtained in St. Louis. They found, in the absence of clinical tuberculosis, the following percentages of positive tuberculin reactions: From birth to 1 year, 1.5 per cent; 1 to 2 years, 5.5 per cent; 2 to 4 years, 29 per cent; 8 to 10 years, 30 per cent; 10 to 12 years, 34 per cent; and 12 to 14 years, 38 per cent. Using the X ray for identification of healing calcified lesions in the lungs, in addition to the usual methods, tuberculosis was found by post-mortem examination in children of St. Louis who died from causes other than tuberculosis as follows: Under 2 years, none; 2 to 5 years, 27.3 per cent; 5 to 10 years, 33.3 per cent; and 10 to 18 years, 62.5 per cent.

During a period of three years, Chadwick and Zacks (2) examined 42,000 school children of Massachusetts and tested them with tuberculin by the Von Pirquet method. In this series the children showed a gradual trend upward from 21 per cent of positive reactions at the age of 5 years to 28 per cent at the age of 10, and 35 per cent at the age of 15 years. Of the entire group, 28 per cent of the children gave positive reactions by this method. They also found that children from different sections of the same city showed wide variation in the proportionate number who gave positive reactions. Thus, in one city of 60,000 population, the number of children in different school districts who reacted to the tuberculin test varied from 11 to 60 per cent. The number of reactors increases with the opportunities the child has for contact with bacilli carriers. As in many other communicable diseases, overcrowding affords more opportunities for spread and those from congested areas show a higher percentage of infection. Patients with chronic forms of pulmonary tuberculosis, such as are found in granite quarry workers, expose and infect more children than those suffering from the more acute forms, partly because the latter live a much shorter time after they become infectious. The number of children giving positive reactions to tuberculin is, from these studies, apparently decreasing.

On the other hand, Opie (3) and his coworkers administered the tuberculin test to 4,000 school children of Philadelphia and found from the results that 37.7 per cent are infected with tuberculosis, as indicated by a positive reaction, at the age of 5 years and 90.2 per cent at the age of 18 years. Their work has given no support to the opinion that parallel with the diminishing mortality from disease in recent years, there has been corresponding diminution in the prevalence of concealed infection. They make the statement that not only is latent tuberculosis so widespread that few children escape before they have reached adult life but in many instances it is so advanced that it is a grave menace to life. This prevalence of latent tuberculosis with the somewhat appalling frequency of advanced

infection approaching manifest disease suggests that mortality from tuberculosis might again increase if conditions favoring the disease, such as prevailed in some parts of Europe during the World War, should again make their appearance. Opie states that a close agreement is found between the figures representing the incidence of the tuberculin reaction on the one hand and obvious occurrence of tuberculosis observed post-mortem on the other, and it seems probable that tuberculous infection of children proceeds more slowly in this country than in some of the cities of Europe. Statistics concerning the incidence of the tuberculin reaction in adults are widely divergent and very unsatisfactory but suggest that the incidence of the reaction is lower among adults than among children.

The childhood and the adult types of tuberculosis.—Two types of tuberculosis in the human being are generally recognized, the childhood type and the adult type. Acute tuberculosis, as Opie writes, is usually a disease of childhood and is obviously acquired by contagion. Chronic tuberculosis is, in most instances, a disease of adults and its transmission by contagion is not usually evident. Acute tuberculosis of children resembles the disease which occurs in susceptible animals inoculated with the tubercle bacillus. Chronic tuberculosis, and especially chronic pulmonary tuberculosis, has little resemblance to the disease caused by the usual methods of animal inoculation.

In general, the chief or most noticeable differences observed in autopsies in any unselected series of cases, between the effects of tuberculous infection in the infant and young child as contrasted with the effects in the adult and older children are (a) in children, a tendency to a more extensive involvement of lymph nodes; a greater tendency to the rapid spread of lesions, and to the development of miliary tuberculosis; and (b) in adults, a greater tendency to fibrous encapsulation and to healing of lesions.

In discussing the influence of age alone, Rich and McCordock (4) state that, so far as is known, there is no inherent difference between the normal bodies of children and of adults which might account for the observed differences in reaction to the bacillus. On the one hand, it is well known that adults from uninfected regions are, when exposed to the tubercle bacillus, ravaged by a type of tuberculosis which has the characteristics of that which we are accustomed to see in children. On the other hand, we are quite familiar with the occasional case of tuberculosis in children, in which the process is exactly like that of the adult type. In the lungs, for example, the encapsulated cavities and the fibrosis appear as a miniature of the chronic phthisis of adults. Finally, these authors state, the most careful investigations have failed to prove that the reaction of normal

young animals to the bacillus is different in any way from that of adult animals. The evidence available at present is entirely against the view that age difference, in itself, is a factor of importance in the development of these two broad types of tuberculosis. The discussion on this subject which follows is based upon the argumentative article by Rich and McCordock (4).

Childhood type.—Some investigators have attributed the differences between tuberculosis in the adult and in the child to the result of certain factors among which may be mentioned, in the inverse order of their importance, (a) differences in the character of the connective tissue enveloping the lesions, (b) differences in the lymphatic systems of adults and children, and (c) the degree and influence of allergy. They believe that allergy is greatest in the young child, that is, shortly after the primary infection, and that it diminishes in the course of time so that in adults it is at a much lower level. Since they hold that immunity is attained through allergy, it follows that the infected child must possess a greater acquired immunity than the infected adult. This greater acquired immunity of the child is thought to be counterbalanced by the supposed fact that an infant can not form connective tissue under any circumstances as well as an adult; therefore, the lesions in the former are poorly encapsulated and, by the supposition that whereas the lymphatics of the child's tissues are wide open, unobstructed channels, the lymphatics of adults as a result of traumatism, various slight infections, etc., become impermeable to such an extent that the transportation of bacilli is inhibited. Thus, in spite of its greater acquired resistance following infection, the two latter circumstances favor, in the child, more easy spread of bacilli not only locally by extension but also by lymphatic transport to regional lymph nodes.

As to the supposed inferior ability of the young child to build up connective tissue, the formation of cicatrices following burns of the skin, the dense strictures of the esophagus after the ingestion of corrosive chemicals, etc. are evidence that scar tissue can be formed in abundance and promptly in infants, providing there is nothing to prevent such formation. It is also a well known fact that surgical wounds in infants heal more rapidly than in adults. Furthermore, even the "primary" tuberculous lesions found in the lungs of infants and young children are often densely encapsulated by connective tissue. The experimental studies of Maximow (5) are interesting in this connection. Embedding very small celloidin chambers in the tissues of the abdominal wall of adult and newborn animals and following the reaction about them from day to day, he found that "in principle, aseptic inflammation and scar formation proceed in newborn animals exactly as in adults, except that the

processes in the newborn occur at a more rapid rate. . . . At the end of four days all of the more impetuous processes have entirely ceased, and the encapsulating tissue has approximately the same appearance as that observed in adult animals at the end of 15 days."

Rich and McCordock, however, do not subscribe unreservedly to the idea of the importance of connective tissue as a primary factor in checking the progress of a tuberculous lesion. They hold that the formation of a connective-tissue encapsulating wall is a result of resistance rather than a cause in that it is purely a reparative process and will always be formed if, and when, the bacilli cease to propagate rapidly. Also they question seriously the efficacy of a few millimeters of connective tissue as a barrier able to restrain the proliferation of the microorganisms. "This skepticism may be realized to be not entirely unwarranted if one pauses to consider the manner in which even solid bone crumbles in the face of vigorously multiplying tubercle bacilli." When quiescent bacilli have become encapsulated, their spread to another site will, of course, be interfered with mechanically, but were those inclosed bacilli not held in an inactive state by acquired resistance, the connective tissue about the lesion would be rapidly destroyed.

It has been frequently observed that when an individual harboring a tuberculous infection becomes "run down," his resistance is lowered, the bacilli break through the connective tissue wall, and infection extends to the tissues about the focus. Neither the connective-tissue wall, nor any other tissue, will act as a competent barrier to a sufficient number of virulent bacilli when resistance becomes lowered. The essence of the resistance question, write Rich and McCordock, seems to be not in the ability of the body to form connective tissue about the bacilli, but in the inability of the bacilli to propagate freely in the particular body in question and this, they believe, is dependent upon the immediate condition of the body fluids and cells, whether possessed naturally, acquired through infection, or lost under debilitating circumstances. If the formation of connective tissue were actually of fundamental importance in preventing the growth of the bacilli, and if in early life the ability to form connective tissue were really less than in later life, newborn animals should develop more extensive lesions after infection than adult ones, which is not the case.

In other words, they believe that less connective tissue is formed about progressing childhood tuberculosis because the bacilli are multiplying more rapidly and the lesions spreading more rapidly than in the average adult case, and that consequently the opportunity for repair is diminished; not that the bacilli multiply rapidly and the lesions spread rapidly because the child can not form con-

nective tissue or has not had time to do so. Instead of the patient being as resistant as the tissue surrounding the tubercle, these authors believe that the patient is as resistant as his acquired ability to hold in check the growth of the bacilli.

In regard to the degree of obstruction of the lymphatics in the adult as compared with the child, doubtless, focal inflammations happening as age progresses may obliterate an occasional lymphatic channel. Senile atrophy involves lymph nodes as well as other organs, and unquestionably very considerable lymphatic obstruction occurs in special conditions, but it can hardly be assumed that the lymphatics of the average young or middle-aged adult are so obliterated that easy drainage is not possible. It is perfectly familiar, write Rich and McCordock, that the sinuses of the bronchial nodes in adults with ordinary pneumonia are flooded with cells and débris, and the same is true during acute tuberculous pneumonia. Similarly, the contents of the distended sinuses of adult mesenteric nodes during typhoid or other ulcerative intestinal processes offer ample evidence of the potency of the associated lymphatics. Furthermore, the fact that aboriginal adults on their first contact with the bacillus develop the "childhood type" of tuberculosis with the characteristic lymph node involvement, even when such adults come from the desert where there is abundant opportunity for inhalation of irritating dust, is itself obvious evidence that the mechanical obstruction of lymphatics in adult life must have little effect in preventing spread to regional nodes. Also in view of the deplorable ease of transport of large cancer cells to lymph nodes in adult life, it seems highly unlikely that simple obstruction could account for the lack of spread of tubercle bacilli.

Some interpret caseation to be a result of the allergic reaction and, as the allergic reaction is regarded by them as a reaction of immunity, caseation, therefore, is a sign of resistance. Tissue is destroyed, but bacilli are killed in the process. Others believe that tissue undergoes caseous necrosis not in connection with any immune reaction, but because the body has little resistance and is hypersusceptible to the products of the bacillus. Also infected children with their tendency to a rapidly spreading tuberculosis give brilliant tuberculin reactions, indicating a high degree of allergy which, according to the first premise above, would represent a corresponding degree of resistance. It may be mentioned in this connection that Unshelm (6) from his observations in 205 cases of acute tuberculosis in children states that a conclusion with regard to the activity or inactivity of an existing tuberculosis can not be drawn from the intensity of the Von Pirquet reaction. Rich and McCordock do not ascribe to the idea that the infected child has an acquired resistance greater than that of the infected adult. They hold that the allergic reaction is independent of

the mechanism of immunity and that the tuberculin reaction is not a measure of the degree of resistance. In support of this view, they cite the experiments of Willis in which animals with practically no allergy were nevertheless highly resistant.

Virulent bacilli reaching the lung, for example, of the previously uninfected child, multiply and produce the initial lesion. Many or most of the bacilli are promptly carried to the regional lymph nodes. Here they flourish in nonresistant soil, gaining a foothold, if their numbers become sufficient which resistance, when it appears, can not destroy, and progressive extensive node lesions supervene. Fibrous tissue will fail to be prominent about the lesions in proportion to the degree of multiplication of the bacilli, the rapidity of development of allergy, the consequent rapid extension of infection and necrosis, and, therefore, the lack of a quiescent field in which repair can proceed unhampered. It is only in the very rarest of cases, according to Rich and McCordock, that no attempt at repair about the original lesions can be seen. In these instances, acid-fast stains show great numbers of bacilli and it is evident that caseation is progressing so rapidly and extensively that any early attempts at repair about the original lesion have become completely effaced by the necrotizing effects of tuberculo-protein through allergy. The usual failure of the more extensive pulmonary lesions in children to have the fibrous character of the chronic phthisis of adults is due to the common manner of pulmonary infection responsible for extensive areas of caseation in the lungs of the former. That is, the sudden discharge of huge numbers of bacilli from a caseous lymph node into a bronchus.

A similar aspiration of large quantities of bacilli in the adult, such as from a cavity, leads to exactly the same result. When smaller bronchial erosions occur in the child, as frequently happens in military tuberculosis, and fewer bacilli are discharged into alveoli, the small areas of pneumonia so produced may be encapsulated or replaced by fibrous tissue exactly as in adults. If the material aspirated into a bronchus from a caseous node is not too heavily laden with viable bacilli, extensive fibrosis of the lung with cavity formation, identical with that seen in adults, may occur. The only other ways in which extensive, nonencapsulated pulmonary lesions can be produced in the child are, according to these authors, (*a*) by the primary aspiration of large numbers of virulent bacilli from the outside, which then proceed to create a progressive lesion in the non-resistant tissue; and (*b*) by the lodging of a few virulent bacilli in the lung, followed by a delay sufficiently long in the development of resistance to permit the bacilli to increase greatly in numbers before resistance appears. While we know absolutely nothing about variations in the length of time required for resistance to appear in the human body and since numerous factors can undoubtedly depress this

mechanism after it is established, it is reasonable to believe that the same or other factors may interfere with its prompt development. It is well known that allergy, that other condition of altered reactivity, will vary greatly in the rapidity with which it develops to a given degree in animals of the same species and used in the same experiment.

The character of the lesions, the extent of regional node involvement, and the course of the disease in progressive childhood infection, then, are perfectly typical of the response of the normal guinea pig to a first infection with a sufficient quantity of virulent bacilli. It is surprising when we consider the fact that the huge caseous nodes of children are relatively enormous foci of progressive infection in proportion to the size of the body, that extreme miliary tuberculosis is not inevitable in every case of advancing tuberculosis in childhood.

Adult type.—Because of the almost universal infection of adults in civilized communities, resulting from the constant exposure to the bacillus from early childhood, and manifested by the quiescent tuberculous lesions found at autopsy, the adult must be regarded as immunologically comparable to an animal previously given a primary, protective inoculation of bacilli which has resulted in a localized encapsulated lesion. As a consequence of this localized infection, the body of the adult, just as that of the experimental animal becomes allergic and the products of the bacillus more readily produce necrosis and inflammation of its tissues. It possesses acquired resistance. That is, the bacilli not only can not thrive as well in the resistant body but appear to be held fixed wherever they lodge so that the spread of viable organisms is delayed and greatly hampered. Although the apparent fixation may be the result of the more prompt and widespread death of bacilli in the resistant body, as Rich and McCordock believe, the effect is quite the same for all practical purposes as though the bacilli were really held fast where they lodge and the phenomenon will be referred to as one of local fixation.

Most city-dwelling adults carry two distinct forms of quiescent pulmonary lesions from which phthisis could conceivably develop. One, the childhood primary infection which is exogenous in origin, appears as an indiscriminately situated, spherical, caseous or calcified encapsulated nodule associated with similar nodules in the bronchial lymph nodes. The other type, a later lesion of reinfection, is by far most frequently situated at or near the apex and appears, on section, as a spider-shaped or a plaquelike scar, often containing small foci of caseation or calcification. The latter lesion is associated with only minimal changes in the bronchial nodes, that is minute, usually microscopic, tubercles or scars.

"There is very good evidence that adult phthisis is not ordinarily an outgrowth from the original childhood infection. Opie believes, from the results of animal inoculation of primary childhood lesions, apical lesions, and apparently normal lung tissue, that the bacilli responsible for the animal tuberculosis which often follows the inoculation of primary lesions removed from adults' lungs really come, not from the lesions themselves, but from surrounding normal lung tissue. He thinks that the bacilli of the primary complex of childhood die out before adult life is reached." His demonstration of living tubercle bacilli in lung tissue without tuberculous lesions is also of interest. Whether or not the primary lesions of childhood actually become sterile with the passage of years, Rich and McCordock believe there are definite pathological reasons for agreeing with Opie that adult pulmonary tuberculosis does not ordinarily represent a reactivation of the original childhood lesion. If we omit simple fibrous scars and include only those lesions which are characterized by caseation or by consequent calcification, writes Opie (7), healed focal lesions implicating both parenchyma and adjacent lymph nodes are found in the lungs which contain these apical lesions, and there is little reason to doubt that a preexisting focal lesion has modified the course of the apical infection. The character and position of the focal lesion furnish support to the view that the apical disease is not derived from the focal but represents a new infection, for in most instances the focal lesion is encapsulated and firmly calcified, and in fully one-half of these instances, the two lesions are in opposite lungs. One-third of pulmonary apices with no gross or microscopic evidence of past or present tuberculosis, according to Opie, have contained living tubercle bacilli and lung tissue from the bases have contained the microorganism only slightly less frequently. Adult phthisis is characteristically apical in location while the primary focus of childhood is as frequently in one part of the lung as in another.

It seems, then, that adult tuberculosis can not be said to arise from the childhood focus unless it be assumed that the bacilli of primary infection remain alive only in those lesions which happen to be situated at the apex. Furthermore, if the bacilli of the childhood lesions remain alive in sufficient numbers to cause the pulmonary tuberculosis of adults their tracheobronchial nodes should show extensive involvement, for these nodes are as heavily infected in childhood as is the lung if not more so. Ranke has stated in this connection that the nodes associated with the primary infection usually contain lesions which total 12 times the mass of the lung focus. The tracheobronchial nodes associated with adult phthisis, however, are remarkable for the slight amount of infection which they show.

Finally, it is common to find the undisturbed, quiescent, encapsulated lesion, typical of the childhood primary focus, in one of the lungs of adults with chronic apical phthisis. Autopsy material shows that there exists every grade of lesion in transition from the freshly forming apical lesion to the fibrous scar on the one hand and to progressive phthisis on the other. "There is no question but that the apical lesions of adults may progress to outspoken phthisis. It is further perfectly clear that these apical lesions are themselves the results of reinfection. Their fibrous nature together with the insignificant involvement of the regional lymph nodes are clear manifestations of acquired resistance; and, besides, one may find a fresh apical lesion of this type in the process of formation in one lung, a distinctly older one in the other, and somewhere else in the lungs the still older, quite different primary nodule representing the childhood infection. The question as to the endogenous or exogenous origin of adult progressive phthisis is inseparable, therefore, from the question whether the bacilli of the ordinarily quiescent apical lesion came from without or from within the body." These lesions may conceivably be the results of hematogenous metastases from an earlier lesion somewhere else in the body or they may result from inhalation of fresh bacilli from without.

The views of Douglas and Pinner (8) regarding apical and subapical lesions are of interest. They believe that the evidence points strongly to the conclusion that nodular apical tuberculosis is not an incipient lesion but a more or less benign process of long standing, with little or no tendency to progress while the infiltrative subapical lesion is usually of quite recent origin and is potentially more grave from the viewpoint of progression of the disease. They hold that the clinical and röntgenologic characteristics of the latter do not explain the nature of its beginning or its relation to the primary infection of the individual. The pathologico-anatomic nature of these two types indicates that the chronic apical lesion is a nodular productive one, whereas the infiltrative subapical type is probably an acute exudative lesion or, in other words, a broncho-pneumonia of tuberculous nature.

If spread of the disease is to occur within the body and a quiescent apical lesion converted into active phthisis, the lesion must, in the first place, contain a relatively large number of bacilli, for even the almost completely unresistant child is able to hold a few bacilli in check. In the second place, it is well known from clinical observation that a sufficiently large number of virulent bacilli harbored anywhere in the body will begin to grow and to produce progressive lesions if resistance becomes insufficient to prevent their multiplica-

tion. It is also known that resistance to tuberculosis unquestionably diminishes under the influence of certain diseases and of other circumstances which are less clearly definable. On the other hand, while small numbers of bacilli introduced from without are relatively harmless to the individual with good acquired resistance, large numbers of bacilli will grow and produce progressive lesions even in the face of resistance. Since, however, sudden massive doses acquired from without must be uncommon in adult life, state Rich and McCordock, "we believe that tuberculosis developing in adult life practically always owes its inception to a temporary period of lowered acquired resistance which permits the development of progressive infection from without from smaller doses, or else the extension of a focus already within the body. Which of these processes is the more frequent we can not say with certainty."

The mass of experimental evidence supports the supposition that acquired resistance, although it fluctuates, very rarely disappears completely once it has been established by the primary infection. Comparison of lesions in human beings with those occurring in animals leads to this conclusion and the quiescent apical lesions of adults, often multiple and of different ages, are themselves indicators of this fact. The character of these inactive and obsolete lesions is evidence of the presence of acquired resistance at different and unselected periods throughout the life of the adult. Again, one finds, though rarely, in city-dwelling adults cases of progressive tuberculosis showing little evidence of repair and associated with large caseous lymph nodes resembling those found in children. It is possible that these cases are the result of the persistence of unusually large numbers of living bacilli in both the pulmonary and node lesions of the childhood "primary complex" so-called by some German writers, with subsequent growth of the microorganisms in the lungs and nodes during a period of lowered resistance. It is also possible that these cases represent a fresh infection from without in a previously uninfected individual, or in one in whom resistance, if it ever existed, had been completely lost. That such cases are rare is strong support, according to Rich and McCordock, of the idea that the bacilli of the primary complex do not commonly survive in numbers large enough to serve as the origin of adult phthisis. Their infrequency is also strong evidence that resistance once acquired in childhood, is rarely completely lost for, if this were to occur, the adult would be reduced to the condition of the nonresistant child, or to that of the previously uninfected aboriginal adult, and infection would more often be of the type ordinarily seen in the child.

In the adult during a period of lowered resistance, bacilli resting in a focus in the lung, for example, or introduced from without in

sufficient numbers, are able to multiply. Since some degree of acquired resistance is usually retained, the bacilli can not grow as well and can not acquire the impetus which their more rapid, immediate proliferation secures in the completely nonresistant body. Growth, then, is more rapid than in the highly resistant body, but more slow than in the nonresistant one; there are few bacilli in the advancing margin of the lesion; tissue destruction is less rapid than in the non-resistant body, and the opportunity for the reparative process is therefore greater. This sequence of events takes place in experimental infection of animals with any degree of acquired resistance, if the reinfecting dose of tubercle bacilli is not too large. Furthermore, in the presence of the new, progressive infection resistance may be expected to rise again to a high level unless interfered with by antagonistic circumstances. From the periphery of the lesions, bacilli are drained to the hilum nodes, slowly and in small numbers, for they tend to be "fixed" or immobilized wherever they are spilled. No progressive extensive lesions occur there as in the case of the child for the reason that the few bacilli reaching the nodes at any one time lodge in tissue which has some resistance. The bacilli either die and disintegrate or else their growth is poor and a tubercle is formed about them exactly as happens when occasional bacilli are introduced anywhere into the tissues of an animal with some degree of acquired resistance. According to Rich and McCordock, such tubercles are numerous enough in microscopical sections of hilum nodes from cases of tuberculosis in the adult. They have studied hilum nodes, which appeared, grossly, almost normal, from cases of adult chronic phthisis with fresh tuberculous pneumonia and found on the one hand evidence of free lymphatic drainage. Tubercle bacilli, on the other hand, although stainable in great numbers in the adjacent lung tissue of the same section, were excessively rare in the nodes, and the lesions produced there were, for the most part, the microscopic foci of epithelioid cell tissue which are to be expected as a result of the presence of few viable bacilli. Small foci of caseation in the centers of the tubercles are common enough, and when fresh can always be shown to be associated with the presence of a focus of bacilli. The effects of resistance upon the bacilli is impressive in these nodes, for the microorganisms persist for so short a time that they have completely disappeared from all but the freshest of the foci of caseation.

As for the lesser tendency to miliary tuberculosis in the adult, these authors believe that two factors influence the development of miliary tuberculosis in any case. First, the factor of resistance; and second, the degree of blood-stream infection. Tubercle bacilli escaping in moderate numbers into the blood stream from an established

focus ordinarily lodge everywhere in resistant tissues. Many or even most will undoubtedly die without producing any lesion. Others surviving and slowly multiplying will give rise to occasional tubercles, and even some of these will resolve because of the death of the bacilli within. The factor of resistance in this connection is exceedingly important for every individual with a progressive tuberculous focus, whether adult or child. As has been stated, we know from blood cultures that practically all such individuals have frequent periods of bacilleemia. Were it not for the prevention through resistance of growth of bacilli, the most widespread infection of all tissues would inevitably result, just as has often been observed following intravenous injections of bacilli into normal, nonresistant animals. Since the degree of acquired resistance is known to fluctuate, if bacilleemia should occur during a period in which this mechanism is depressed, bacilli could be expected to survive and propagate wherever they chance to lodge. Both the adult and the child, however, ordinarily possess some degree of resistance. The second or balancing factor which will determine whether or not lesions in distant organs, occasional "disseminated tubercles," or frank miliary tuberculosis will result in the face of a given degree of resistance is therefore the degree of blood-stream infection; for resistance, at best, in tuberculosis is only relative and can always be overcome if a sufficient number of bacilli are discharged at any one time from a focus of infection. Thus, miliary tuberculosis may be produced with ease in animals with high acquired resistance by means of rather large intravenous injections of bacilli; whereas smaller doses cause merely "disseminated tubercles" or no permanent lesions whatever. Not only does the more rapid extension of the lesions in the child, as opposed to the leisurely progress with peripheral repair in the adult, favor a more expeditious and extensive infection of microscopic and larger vessels in the child; but the continual streaming of lymph through infected, necrotic nodes and thence into the subclavian vein in nodal tuberculosis itself, might be expected to be a form of the disease especially favorable to blood-stream infection. If it were not for the presence of some degree of acquired resistance in the child, write Rich and McCordock, it is inconceivable that any case in which nodes were caseating could escape the most widespread infection; and we have, in fact, repeatedly observed in children the healed "disseminated tubercles" which are recognized as earmarks of acquired resistance in the adult. There is evidence, however, that not infrequently tuberculosis becomes generalized in the child before a maximal degree of resistance, comparable to that of the adult, has had time to be developed.

In brief, the attitude of these authors toward the problem of the differences between progressive adult and childhood tuberculosis is as follows:

In the child, bacilli lodging locally grow freely in the body without resistance; many are swept early, in viable condition, to lymph nodes, and if in sufficient numbers and of sufficient virulence, can grow unchecked and attain to numbers large enough to be too strong for resistance when it at length appears. With the development of allergy in the presence of large numbers of proliferating bacilli, progressive, caseous lesions in lymph nodes and elsewhere, advancing too rapidly to permit much repair, become prominent. Progressive lesions in almost all city-dwelling adults develop under the influence of some degree of resistance acquired through the primary and subsequent infections, and they progress more slowly because the growth of the bacilli is retarded by this resistance. Because of the slow extension of tissue damage the opportunity for repair is greater. Viable bacilli are swept to nodes less freely because of the mechanism which, in the resistant body, apparently tends to "fix" them at their site of lodgment, and, more important, they grow there poorly because they lodge in resistant tissue; extensive nodal tuberculosis is therefore uncommon. Blood-stream infection occurs during the course of all localized progressive tuberculosis whether in adult or child. It usually, in human infection, occurs in significant degree only after there has been time for the development of some measure of acquired resistance; and, depending upon the degree of resistance and the numbers of bacilli carried to distant organs by the blood, either no permanent tubercles, sparsely scattered disseminated tubercles, or myriads of tubercles (miliary tuberculosis) will result. The first result is very rare in adult or child, for at least a few of the disseminated bacilli produce permanent tubercles in practically every case. The second result is common in both adult and child. The last result (miliary) is more common in the child because the character of the childhood lesions is more favorable to heavy blood-stream infection. The explanation of the differences between adult and childhood tuberculosis lies in the events which happen in the child before the appearance of acquired resistance.

Human infection.—Pulmonary tuberculosis of children, as stated before, has the characteristics of tuberculosis produced experimentally in animals and pursues a similar course. The lesions occupy one part of the lung as frequently as another and are accompanied by tuberculosis of the regional lymph nodes which in most instances progresses more rapidly than the pulmonary lesion responsible for the spread. Infants are susceptible to infection, the source of which can usually be traced to a parent. Holt, however, cites an instance in which 10 infants were thought to have been infected by a tuberculous midwife who established respiration at birth by mouth-to-mouth insufflation. Evidence of infection appeared within 14 months. Tending to progress during the first year of life, the disease usually causes death from generalized tuberculosis or from tuberculous meningitis. The disease seems to persist longer during the second year of life, but the tendency to repair is scant. To compensate for the violence of its advance, however, there is in children,

according to McPhedran, a capacity for rapid retrogression and healing, including the disappearance of moderate and, occasionally, large cavities that is nothing short of amazing. Later in life the progressive fatal forms of the disease are less common.

Adults are usually insusceptible to infection, and in few instances is it possible to trace with certainty the source of phthisis presumably acquired during that period of life. In them pulmonary tuberculosis has its origin in the apex of the lung, develops slowly with the production of fibrous tissue but without involvement of the regional lymph nodes, and when advanced causes the formation of cavities. It resembles a second infection in experimental animals or, in other words, reinfection in the face of acquired resistance. The differences between the childhood and the adult types of tuberculosis are summarized by Chadwick as follows:

<i>Childhood type</i>	<i>Adult type</i>
Usually occurs in children but rarely in adults.	Usually occurs in adults but may be found in children.
Result of a primary infection.	Result of a reinfection.
May be localized in any part of the lung.	Localization is apical, extending along the pleura, often posterolaterally. The first clinical manifestation, however, is often in the infraclavicular space.
Associated tracheobronchial lymph nodes are always involved but may not be demonstrable.	Tracheobronchial lymph nodes not involved by this reinfection except sometimes in the terminal stage.
Caseous lesions usually become calcified or incapsulated in fibrous tissue.	Caseous lesions usually followed by excavation or fibrosis, or both.
Infiltrated areas commonly resolve, leaving trivial or no scars except for the foci of caseation, which usually become calcified.	Infiltrated areas may resolve with the production of more or less fibrous tissue.
Prognosis good.	Prognosis in children is poor.

In adults prognosis in the early stages of the disease is usually good. As a general rule, the earlier the disease is recognized and appropriate treatment established, the better the outlook.

Tuberculosis is essentially a family disease. Opie (9) basing his conclusions on the results of an analysis of the data furnished by nearly 400 families studied in the dispensary of the Henry Phipps Institute states that in families with no tuberculosis 30 per cent of those less than 10 years of age were found to be sensitive to tuberculin and 10 per cent exhibited, on Röntgenological examination, lesions of latent disease, while in families with open tuberculosis, 80 per cent gave positive tuberculin reactions and latent lesions were demonstrated in 30 per cent. These figures indicate that infection oc-

curred from sources outside as well as within the family. It was also found that the incidence of latent tuberculosis, as measured by Röntgenological examination and by the tuberculin reaction, has not been greater in families suspected of having tuberculosis than in those whose members showed no evidence of infection.

Of 124 children from families with open tuberculosis in a parent, approximately one-fourth have had isolated nodules in their lungs and another fourth have had massive tuberculosis of the tracheo-bronchial lymph nodes. Of the remainder, 4 adolescent children have had latent apical tuberculosis and 11 children have suffered with manifest tuberculosis. Isolated nodules of the lung have apparently little significance and as they represent a relatively scant infection, are not an evident source of danger to the individual. On the other hand, the presence of a calcified tracheo-bronchial lesion, according to McPhedran (10), suggests that the initial infection received by a child was large or that a massive second infection occurred at a time when the relative resistance resulting from a trivial first infection had largely disappeared. Such massive infections, which are usually the result of intimate contact, may have occurred and ceased in early childhood, or may have taken place or been continued toward the years of puberty. If the lesion represents the former, it is decidedly of less significance than if it represents the latter.

When a case of tuberculosis is discovered it is important that all other members of the family should be examined to the end that any disseminator of tubercle bacilli be found and further spread prevented. It is not enough to depend upon physical examination to exclude tuberculosis. The history in many cases is not reliable as previous illness is often forgotten or denied. A Röntgenogram is needed to reveal fibroid cases that are frequently of long duration and may have few or no physical signs, and because unrecognized cases are a great menace to the community. McPhedran states that "if the history suggests that contagion began and ended years ago, as by the death of a parent from tuberculosis, it is still important to make sure that some other member of the family, acquiring this insidious disease from the original contact, has not since unwittingly become a source of reinfection. An older brother, for example, may have been infected by the parent at about the age of puberty, when he was more likely than the younger children to develop a lesion that would constitute a source of infection. He may be now transmitting his infection to the younger children as they approach the same dangerous period in their lives, when the majority of the lesions in children that become clinically manifest develop.

"Furthermore, it is clear that a child who is first exposed to massive intimate infection about the age of puberty, by which time

he is likely to have been mildly infected during his school years, is much less liable to suffer a massive and demonstrable lymph-node lesion, such as commonly results from similar exposure of uninfected children. His apical lesion, if one develops, is likely to be unaccompanied by a demonstrable lesion of the lymph nodes."

According to Opie, three possible modes of infection have been widely discussed; namely, by dry dust, by moist droplets, and by contamination of food or other objects that enter the mouth. "Since living tubercle bacilli are killed by drying and light, dust is no longer regarded as the chief source of infection. At the Henry Phipps Institute, we have collected dust from the air in the home of patients with open tuberculosis, but have almost invariably failed to obtain tubercle bacilli by animal inoculation." On the other hand, Augustine (11) found that dust from the rooms or clothing of patients who kept themselves clean contained tubercle bacilli much less frequently than dust from uncleanly homes and people. "Tubercle bacilli are recovered more frequently from the rooms of women than of men with open tuberculosis, and less frequently from the clothing of women than of men. These relations may be explained by the greater personal cleanliness of women and their inability, when ill, to keep their houses clean." Brown (12) selected two patients with abundant sputum loaded with tubercle bacilli and had them cough violently into their hands. The wash water from their hands infected guinea pigs, but tubercle bacilli could not be transferred from hand to hand by shaking hands or by means of the door knob. Baldwin (13) exposed animals with primary infection to various dusts and found that reactivation of tubercles occurred with quartz in 73.6 per cent, with carborundum in 31.8 per cent, and with granite in 26.3 per cent. Marble and soft coal apparently had no effect.

Again quoting Opie, "available evidence favors the view that tubercle bacilli may be transmitted by moist droplets thrown out by coughing." Anatomic observations, he writes, indicate that the tuberculosis of childhood is in great part aerogenous and has its primary localization in the lungs. There is, obviously, abundant opportunity in infancy and early childhood for transfer of tubercle bacilli by direct contact with the tuberculous mother or nurse. Milk, particularly in some countries, is an important source of infection which enters the body by way of the gastrointestinal tract and affects the mesenteric and cervical lymph nodes. The presence of bacilli of the bovine type, however, is exceedingly rare in tuberculous lesions of the lungs.

Opinions are conflicting with respect to the origin of adult infection. Of three different groups there are (1) those who believe that

tuberculous infection in every case arises from the primary childhood focus, that is, from endogenous reinfection at any time in later life; (2) those who regard many or even most cases of pulmonary tuberculosis in adult life as due to infection from without or in other words to exogenous reinfection, largely from inhalation, which, in most civilized countries, occurs upon a more or less sensitized or allergic soil; and (3) those who hold that both endogenous and exogenous reinfection can occur, but that possibly endogenous reinfection is the more common and that exogenous reinfection rarely takes place after the twenty-fifth year.

Lawrason Brown believes it highly probable that all persons living in civilized communities rarely pass through a year without taking in some tubercle bacilli from the outside. He states that some of these implantations up to the end of the third decade may be primary infections which are successfully combatted through the natural resistance of the individual although he is at the same time rendered allergic to later infections. In other instances these implantations result in reinfections and may add to the immunity already present or if resistance happens to be low, they may produce a definite focus of disease which may, for a longer or shorter period of time, remain undiscoverable by clinical means. "The occurrence of debilitating circumstances may finally bring this adult infection, or more often reinfection, into activity and clinical disease thus result. It is not likely that reinfection is followed at once by clinical disease. The period during which reinfection takes place may extend from infancy to middle life, but exogenous reinfection probably occurs most frequently from the fourth to the twentieth years." He is convinced that a certain percentage, somewhere between 20 and 40 per cent of adult pulmonary tuberculosis, is due to infection after puberty.

Opie and his coworkers hold that the evidence they have obtained supports the view that adult tuberculosis is not derived from the childhood type of infection, but is exogenous in origin. It is noteworthy they state that the grave tuberculous lesions of adolescence characteristically implicated the apex and conformed with tuberculosis in adults. In approximately one-half of these cases the calcified scars of a first infection were large enough to be recognized by röntgenological examination. They also state that numerous observations have amply confirmed the fact that latent apical tuberculosis of adolescence is often the precursor of manifest disease of early adult life.

Chadwick, in his pamphlet, *Childhood Type of Tuberculosis*, 1930, National Tuberculosis Association, states that from one-third to one-half of the cases of tuberculosis of the adult type found in adolescents have had a preceding childhood type of disease that is evident

from the calcified lesions seen in the röntgenogram. Therefore, individuals below the age of 20 who are known to have the childhood type of tuberculosis should be advised to avoid strenuous exercise unless their tuberculin reaction is negative and contact is known to have ceased in early childhood. "Without this precaution there is great danger in these cases that excessive strain may reactivate dormant infection."

According to Baldwin (15) it was observed during the World War that men brought in contact with tuberculous infection for the first time developed an acute type of tuberculosis similar to that of childhood. Although a few acute cases occurred among men who undoubtedly had escaped infection in early life, most cases of tuberculosis among European and American troops were distinctly different and corresponded to the adult type. In the majority of instances, however, manifest tuberculous disease among soldiers in the late war could be traced, fairly, to previous infection, or as the late Sir William Osler so aptly wrote, "the bacillus enlisted with the soldier." It is stated that during the World War the percentage of recruits for the United States Army who were rejected because of tuberculosis ranged from 2 to 6 per cent of total rejections. In the United States Navy, rejections for all causes during the years 1917 and 1918 amounted to 448,072. Of these, 7,423 or about 1.7 per cent were due to manifest or suspected tuberculosis.

Baldwin is of the opinion that latent tuberculosis in adults is so prevalent that it is fallacious to consider any given case one of recent infection. He states that in one-half of the cases, pulmonary tuberculosis is admittedly begun in the family of the victim and that the previous implantation and autoreinfection can account for the successive stages of the disease. When the disease can not be traced to exposure within the family the tendency is to assume a later date for infection, generally in young adult life, but, when a thorough inquiry is made into the history of each case, early, recurring symptoms of tuberculosis can often be elicited. The occurrence of these symptoms from time to time may indicate successive reinfections from without, although it is well known that some immunity is produced by first infections. In this connection Baldwin has shown that in animals with arrested disease, repeated infection by inhalation of a suspension of tubercle bacilli lead to chronic pulmonary tuberculosis when the dosage is large. The same undoubtedly occurs in human infection, but the great increase of tuberculosis in undernourished peoples during and after the World War connects a large number of these cases with early age infections reactivated by privation and strain. Baldwin believes that the variations in the death rate during and following the war and the influenza pandemic also point to an overwhelming amount of reactivated latent infection. He says:

The more one studies the fluctuation of morbidity and mortality of tuberculosis, the less appears the danger of additional infection during adult life. Much has been said about massive infection causing disease in adults, but when analyzed it can hardly be regarded as frequent or massive. There are too many closely exposed to reinfection without apparent harm to make the danger real. This is shown in married partners and nurses, who are not only unusually exposed, but frequently under debilitating conditions.

In truth, the slightly higher percentage of tuberculosis in widows, widowers, and nurses in tuberculosis hospitals has been charged to massive infection, without full consideration of the other factors which, when acting on unexposed persons, are recognized as causes of reactivation of latent tuberculosis. One must take into consideration the inactive but recognizable pulmonary cases as an index of the potential clinical tuberculosis in the community. The recrudescence of arrested tuberculosis from time to time, even under careful supervision, is familiar to all. The fact that some escape relapses under extreme strain and exhausting labor does not argue that those who relapse receive an added infection from outside; instead, there are conditions present in the body that favor the mobilization of the bacilli always present in the old foci of these cases that may be absent in the first. At the same time, experimental work on animals shows a high degree of protection against the invasion of fresh infection from outside. Either the belief in the frequency of "massive" infection is a mistaken one, or the mechanisms that ward off infection are very efficient, whether the bacilli are inhaled or swallowed.

. . . It seems to me, therefore, that repeated infections occur in the young, gradually leading to disease in some, while in others, after full growth is reached, they are successfully resisted.

In regard to the relative importance of infection through the respiratory and digestive tracts, we can safely regard it as certain, he writes, that for infants and children both avenues are possible, while in adults we deal chiefly with inspired bacilli when they penetrate the tissues at all.

In this connection Petroff (17) and his coworkers have inoculated guinea pigs with as few as 5 to 10 bacilli and found the animals became positive to the tuberculin test in from 70 to 90 days, a period of time approximating that observed in ordinary human infection. They feel that excessive or massive doses of tubercle bacilli, in so far as infants are concerned, are uncommon. "The mere fact that a large number of children become infected without any clinical manifestation of disease leads one to believe that the numbers of bacilli entering the body during infancy or adult life are relatively few and that there must be a normal, possibly nonspecific resistance which by some method can be reinforced and the body become more resistant to small numbers of organisms. In infancy and in childhood when the dosage is excessive the normal mechanism of resistance is completely overcome and progressive fatal disease results. On the other hand, if the organisms are few in number, a period of approximately three months may elapse before the child becomes positive to the tuberculin skin test." Hereditary transmission of

tuberculosis is regarded by most authorities as a negligible factor in the spread of the disease, although some maintain that this event occurs more frequently than is generally supposed. Experimental and clinical data up to the present time bear out the fact that tubercle bacilli are rarely transmitted from mother to child when the placenta is normal and free from tuberculosis. Calmette and others hold that a filterable form of the tubercle bacillus exists, but recent work has cast considerable doubt upon their views. If a filterable form does exist, maternal transmission should be of much more frequent occurrence than has been recognized in the past.

Whether infection is endogenous or exogenous in origin or whether it is by the inhalation or ingestion of infected material, it is certain, according to White (16) that tubercle bacilli enter the body mainly from certain of its surfaces, especially from the mucous linings of the respiratory, alimentary, and conjunctival systems, without apparent abrasion of these. They are probably transported to the interior of the body by one of the wandering phagocytic cells, but which type of cell is involved is of little importance as long as intracellular transportation is effected. It is possible that a polymorphonuclear cell may influence the bacillus in one way and a monocyte in another. It is also possible that any carrier may transport it and deposit the viable bacillus in tissue where environmental influences are favorable to its growth with subsequent production of disease.

The same factors which led to primary infection may continue to exist in later childhood and adolescence and result in more or less frequent implantations of bacilli. These implantations may in turn result in latent apical tuberculosis which may become reactivated under adverse environmental conditions and produce active progressive clinical disease in adults. Certainly the number of investigations now being conducted among school children in various parts of the United States, with the idea of placing under appropriate treatment all those presenting evidence of tuberculous infection or disease, would seem to indicate the seriousness of these conditions in older children and adolescents with regard to the development of progressive disease in adult life.

Length of time between infection and development of manifest disease.—In most acute communicable diseases there is a more or less definite period of incubation or length of time elapsing between the implantation of the infectious agent on the surfaces or within the body and the appearance of the symptom complex of actual disease. In tuberculosis, however, there is very little exact information regarding the exact time of infection or the relation from the standpoint of time of infection to the onset of manifest disease. The report of the Committee on Standard Regulations for the Control of Communicable Diseases of the American Public Health Association

give the incubation period as "variable and dependent upon the type of the disease." As has been pointed out, many individuals harbor living tubercle bacilli and an appreciable number have the disease in a latent, unrecognized, or even unrecognizable form. It is quite possible for one so afflicted, and presenting no visible, or for that matter, no audible evidence of the disease, to have a sudden rupture of a small lesion with an accompanying discharge of a number of tubercle bacilli into a bronchus. If this eruption of bacilli is followed by forcible coughing on the part of the host, it is conceivable that bacilli may be projected from a mouth unprotected by handkerchief or hand upon food which is about to be eaten by another, or into the immediate vicinity of a group of persons upon whose mucous membranes of the respiratory tract they are inadvertently deposited by the process of respiration. It is not likely that a chance infection can produce clinical disease, for most of the population of the so-called civilized countries have some relative resistance to infection by reason of previous contact with the bacilli. It usually takes prolonged and more or less intimate contact with a pre-existing case for an otherwise healthy individual to contract the disease. In this connection Baldwin (18) states that the number and frequency of implantations of tubercle bacilli is the important factor and that occasional slight infections can not be regarded seriously for adults when 75 to 100 per cent must acquire them, and only 1 per cent of the population becomes diseased. We know, however, that infection does take place after slight exposure, and that after prolonged exposure over a period of years, the contact does not necessarily become diseased. Unfavorable environmental influences such as overcrowding, malnutrition, and fatigue favor the development of tuberculosis by increasing exposure to the bacillus or by impairing health and by diminishing resistance.

Tuberculosis is a rare disease in Senegal outside of towns where contact with Europeans occurs. Cases of tuberculosis developing among those of the Senegalese troops brought to France during the World War who came from the country districts, were of the childhood type and were indicative of primary infection. After what Borrel termed the initial glandular period and which lasted from one to three months, the disease became generalized and death occurred in from 15 days to 1 month, or rarely in 2 months.

In a study of 110 cases of tuberculous meningitis in children reported in the Weekly Bulletin, Department of Health, New York City, September 8, 1928, it is stated that exposure to tuberculosis in the family does not have to be prolonged in order to transmit the disease. "While in most instances the exposure lasted one or more months, there were cases in which the disease developed following a much briefer period. In one case exposure was only 2

days, in another 11 days." While infection may occur within a few days and generally within a few weeks, signs and symptoms of the disease do not manifest themselves before a period of from four months to a year, or more. The writer observed one case of an infant in whom fever of undetermined origin was followed by tuberculous meningitis and death, 14 months later.

So many cases of tuberculous meningitis terminate in death that the case fatality rate is generally regarded as 100 per cent. It is, therefore, of interest to note two recent cases in which apparent recovery was reported. One of the cases was described by Cain. Tubercle bacilli were found in the spinal fluid and sputum and signs of tuberculosis were present in the lungs. After three months in hospital, bacilli could not be detected either in the sputum or in the spinal fluid, and guinea-pig inoculation proved negative. One month later the patient reported that his condition was satisfactory. The other case was reported by Guter (20). A boy, 12 years of age, developed tuberculosis of the brain following trauma of the head. Symptoms of tuberculous meningitis disappeared in two months' time and recovery appeared to be complete. A calcified tuberculous area in the right lateral ventricle was disclosed on röntgenological examination.

Speaking of the latent period, during which infiltration is discovered röntgenographically, but is not recognizable by the production of symptoms or of physical signs, McPhedren states that the length of this period varies widely. "It may be only two or three weeks during which a consolidation develops in an infant before the first symptom, often cough, appears. It may be as much as three or more years, during which an infiltration in an adolescent, if untreated, descends from the extreme apex where it is recorded only with difficulty, into the subapical areas, where it is readily perceptible and usually, but by no means always, productive of symptoms."

From a careful study of 20 cases of tuberculosis as recorded in the BULLETIN, St. Louis Health Division, April, 1930, it was found that 6 developed the disease within 5 years after exposure; 4, between 5 and 10 years; and 10, or half of them, 10 years after exposure.

In this connection Opie (21) writes:

It is not improbable that what is designated 'incipient tuberculosis' may in some instances be latent phthisis. The possibility that the latent lesion may become active should be held in mind for it may explain the long latent period between the opportunity for tuberculous infection and appearance of symptoms of phthisis.

The incubation period of tuberculosis is very short in early childhood and in infancy may not exceed 30 days, but in later childhood increasing with

increasing age the period between exposure to infection and the appearance of clinical symptoms may be years and even decades. Reiche found among patients with phthisis that 29.7 per cent of men and 44.4 per cent of women had had parents suffering with tuberculosis. In accord with prevailing views he attributed this relation to infection transmitted from parent to child. Analysis of these cases showed that the interval between the death of the parent and appearance of tuberculous symptoms in the offspring was in a large proportion of instances at least 5 and even more frequently 10 or 15 years.

Newsholme determined very carefully in a relatively small group of cases the time which had elapsed between evident exposure to tuberculous infection and the appearance of symptoms of phthisis. In 20 of 100 cases which he studied in great detail there was a definite history of infection ceasing at a known date. The duration of latency was less than 5 years in only 6 instances, from 5 to 10 years in 4 instances and in 10 instances, namely half of the cases, the latent period was greater than 10 years. Had any of this last group died before the onset of symptoms a slowly advancing fibroid lesion would have been found at the apex of the lung.

In another paper Opie states that prolonged and intimate contact with open tuberculosis is essential for successful infection to take place. "In instances in which tuberculosis of the tracheobronchial lymph nodes has been recognized, the average duration of exposure to open tuberculosis has been four years, whereas with latent apical disease, including that of adolescent children, the average period of exposure has been seven years. These figures should be regarded as tentative, and certainly do not represent the minimal time required for infection."

On the other hand Peimer (22) from a study of 200 cases of tuberculosis of the type in which the disease begins in the infra-apical region and spreads rapidly to other parts of the lung, including the apex, reached the following conclusions:

1. Progressive and destructive pulmonary tuberculosis usually begins suddenly, with exudative subapical lesions.

2. Strictly apical productive tuberculosis is not, as a rule, the incipient stage of progressive and destructive pulmonary tuberculosis; it may precede the latter; but even in such cases, the latter starts usually as stated under 1. The rôle which apical tuberculosis plays in phthisiogenesis is rather insignificant as compared to that of acute subapical infiltrations.

3. Lesions far advanced as to extent, and excavations, frequently develop within less than six months.

4. Processes leading to active progression and to excavation are most frequently associated with acute symptoms.

5. Apical involvement, in the majority of patients, is not an occurrence of ineptency but a late development.

Minnig (23) in an endeavor to determine the incidence of conjugal tuberculosis, reviewed the histories of 6,000 dispensary cases.

His conclusions, while not dealing strictly with the duration of contact, are of interest. He found that every individual exposed to tuberculosis in the consort will not necessarily contract the disease but that if the individual's resistance becomes reduced from any cause and the consort has open tuberculosis, there is one chance in six that infection will occur. Tuberculosis in the wife is the more dangerous contact and is more frequently observed in marital tuberculosis. He also found that when one of the consorts died the mate was infected in 50 per cent of the cases and concludes that massive infection coupled with lowered resistance will almost surely result in the spread of infection from one mate to the other.

DIAGNOSIS

According to the "Diagnostic Standards of the National Tuberculosis Association," May, 1928, there are five principal criteria of diagnosis of pulmonary tuberculosis. They are given below.

"1. A history of hemoptysis of one dram or more without any other known cause.

"2. A history of an otherwise unexplained pleurisy with effusion.

"3. Definite râles which persist for a week or more in the upper half of the chest.

"4. Definite evidence of parenchymal changes seen in the X-ray film, located usually in the upper half of the chest.

"5. The demonstration of tubercle bacilli in the sputum on two or more occasions.

"The first and second constitute merely presumptive evidence; the third and fourth, while at times misleading and possibly due to other causes, nevertheless very strongly indicate pulmonary tuberculosis. The fifth is practically always conclusive evidence of pulmonary tuberculosis, although it must be borne in mind that in rare cases, tuberculosis of the tracheobronchial lymph nodes without involvement of the lung parenchyma gives rise to a positive sputum."

This pamphlet contains the following definitions and statements:

HISTORY

1. *Exposure*.—To be of any value in diagnosis, the exposure must be intimate and prolonged, or frequently repeated. (Childhood exposure most important.)

2. *Symptoms*.—(a) Cough and expectoration: There is no cough or expectoration characteristic of tuberculosis, but all such persisting for six weeks or more demand careful examination of the patient for pulmonary tuberculosis and the sputum for tubercle bacilli.

(b) Pain in the chest—pleurisy: This is not necessarily indicative of pulmonary tuberculosis, though perhaps occurring most frequently in this disease. Pain aggravated by deep breathing requires careful examination of the chest.

(c) **Bloody expectoration or hemoptysis:** Any amount of expectorated blood, with or without sputum, may mean that tuberculosis is present and requires careful and thorough medical investigation as to its source. Blood streaks, blood spots, etc., may or may not mean tuberculosis. However, the unexplained hemoptysis of a dram or more is presumptive evidence of tuberculosis.

(d) **Hoarseness and huskiness:** When persistent should always be investigated as to origin. Laryngeal tuberculosis is a frequent cause.

(e) **Loss of weight:** It must be borne in mind that there are seasonal variations in weight. When, however, the loss amounts to 5 per cent or more of the usual weight within a period of three or four months, the cause must be determined. Tuberculosis is a frequent cause.

(f) **Loss of strength:** Lack of endurance; fatigue, not relieved by usual rest, and night sweats are all expressions of some form of intoxication, and tuberculosis is a frequent cause.

(g) **Fever:** The range of normal oral temperature is usually from 97.2° F. to 99° F. It should be borne in mind that elevation to 99.6° F. or more may occur after exercise, after meals, at or about the menstrual period, and in children. Elevations over 99° F. occurring at some time of the day for several days should be regarded as abnormal temperature. The temperature during the period of investigation should be taken every two hours for 10 days by mouth.

(h) **Pulse rate:** When taken after one-half hour of physical and mental rest, the pulse should normally not exceed 85 to 90 per minute in the male and 90 to 95 in the female adult. The pulse rate of a child is so variable that it has not the same significance.

(i) **Presence of tubercle bacilli:** The presence of sputum is not necessary for a positive diagnosis. The constant raising of sputum, with or without cough, requires investigation. Absence of bacilli in the sputum after one or several laboratory examinations is not necessarily proof against the presence of tuberculosis. In children, as sometimes in adults, the laboratory examination of a smear from the larynx or examination of the feces may show tubercle bacilli not found in the sputum. Where laboratory examinations of sputum, feces, urine, etc., are persistently negative, animal inoculation may be made.

EXAMINATION

It is now recognized that the proper taking of X rays, preferably stereoscopic, is an essential procedure in examination of the chest.

1. **Physical signs:** Pulmonary tuberculosis may exist without the occurrence of demonstrable physical signs. Absence of abnormal physical signs does not therefore mean absence of pulmonary tuberculosis.

2. **Radiographic findings:** Definite parenchymal changes are seen in nearly all instances of proved pulmonary tuberculosis. Absence of such changes demands other proof of the existence of the disease.

It may be mentioned here that Dr. F. Maurice McPhedran of the Henry Phipps Institute, Philadelphia, Pa., has kindly consented to prepare an article on the interpretation of radiograms for publication in a forthcoming issue of the UNITED STATES NAVAL MEDICAL BULLETIN.

On the basis of these definitions, the minimum standards in the diagnosis of pulmonary tuberculosis have been found to be as follows:

1. When constitutional symptoms and definite past history are absent or slight, there should be demanded definite signs in the lungs, including persistent râles usually in the upper half of the lung, or definite and characteristic parenchymal changes as shown by the X ray, or the finding of tubercle bacilli. (By "persistent" is meant that the râles must be present after cough at two or more examinations, the patient having been under observation at least one month).

2. In the presence of constitutional symptoms, such as loss of weight and strength, etc., as defined above, there should be demanded some abnormality in the lungs on physical or X ray examination or both (but not necessarily râles).

3. Usually a process in the upper half of the chest would be considered tuberculous and a process in the lower half nontuberculous, until the contrary is proved.

4. Hemoptysis or pleurisy with effusion is only presumptive evidence of the disease.

5. Pain in the chest and shoulders, night sweats, digestive disorders, etc., require careful examination of the lungs for evidence of the disease. The presence of any extrapulmonary tuberculous lesion necessitates careful examination of the lungs. This includes especially fistula in ano, adenitis, joint tuberculosis, etc.

6. In every doubtful case one should demand that the patient be kept under observation and a record kept of pulse, temperature, weight, etc., for at least one month, with repeated sputum examinations, before a definite diagnosis is made. The importance of careful and thorough observation for at least one month is to be emphasized.

7. Tuberculin tests and other special laboratory diagnostic methods are of use only when in the hands of those specially trained and experienced in their interpretation.

CLASSIFICATION OF PULMONARY TUBERCULOSIS

The following is the classification adopted by the American Sanatorium Association and by the National Tuberculosis Association.

Schema for the classification of patients on examination

LESION	SYMPTOMS
<i>Minimal: (Incipient).—</i> Slight lesion limited to a small part of one or both lungs. No serious tuberculosis complications.	<i>A. (Slight or none).—</i> Slight or no constitutional symptoms including particularly gastric or intestinal disturbance or rapid loss of weight; slight or no elevation of temperature or acceleration of pulse at any time during the 24 hours. Expectoration usually small in amount or absent. Tubercle bacilli may be present or absent.

LESION—continued

SYMPTOMS—continued

Moderately advanced.—A lesion of one or both lungs, more widely distributed than under "minimal," the extent of which may vary, according to the severity of the disease, from the equivalent of one-third the volume of one lung to the equivalent of the volume of an entire lung with little or no evidence of cavity formation.

No serious tuberculous complications.

Far advanced.—A lesion more extensive than under "moderately advanced." Or definite evidence of marked cavity formation. Or serious tuberculous complications.

B. (*Moderate*).—No marked impairment of function, either local or constitutional.

C. (*Severe*).—Marked impairment of function, local or constitutional.

This classification provides for the following groups and subgroups:

Minimal A.	Moderately advanced A.	Far advanced A.
Minimal B.	Moderately advanced B.	Far advanced B.
Minimal C.	Moderately advanced C.	Far advanced C.

The following definitions of Röntgen findings are based on the study of stereoscopic negatives (plates or films). Fluoroscopy may be of help, but, alone, is of less value.

UNDER MINIMAL

1. *Slight lesion.*—(a) Physical signs: Possibly slight depression above or below the clavicle, lessened movement of the chest, narrowing of the isthmus of apical resonance or restricted diaphragmatic excursion; slight or no impairment of resonance; slight or no change in quality or intensity of breath sounds, with or without some change in the rhythm (i. e., prolonged expiration); vocal resonance possibly slightly increased; rales present, absent, or transitory. If sputum contains tubercle bacilli, any of these.

(b) Röntgen findings: Röntgenograms to show lessened transmission of light in the form of poorly defined, light mottling or diffuse haziness interpreted as infiltration or conglomeration or tubercule, or more intense shadows of a well defined stellate or fibrillar character interpreted as fibrosis, with or without opacities interpreted as calcification.

2. *A small part of one or both lungs.*—Total volume of involvement, regardless of distribution, shall not exceed the equivalent of the volume of lung tissue which lies above the second chondrosternal junction and the spine of the fourth or body of the fifth thoracic vertebra on one side.

UNDER MODERATELY ADVANCED AND FAR ADVANCED

3. *Lesion allowable under moderately advanced.*—One or both lungs may be involved, but the total involvement shall not exceed the following limits:

(a) Slight disseminated infiltration or fibrosis which may extend through not more than the equivalent of the volume of one lung.

(b) Severe infiltration with or without fibrosis which may extend through not more than the equivalent of one-third the volume of one lung.

(c) Any gradation within the above limits.

(d) Total diameter of cavities, if present, should not exceed 2 centimeters.

4. *Physical signs of moderately advanced lesions* are more variable than those of minimal lesions and do not usually determine the exact extent of the involvement.

5. *Röntgen findings in moderately advanced lesions*.—Röntgenograms to show shadows similar in character to those described under minimal (see 1 b), but more extensive or more intense, with or without areas of rarefaction interpreted as cavity formation.

6. *Definite evidence of cavity formation*.—Tubercle bacilli usually present; elastic fibers may be present in sputum. Physical signs may not be definite but a combination of any four of the following signs is to be taken as indicative of cavity formation:

- (1) Bubbling or consonating rales.
- (2) Cracked-pot note.
- (3) Amphoric breathing.
- (4) Intense whispering pectoriloquy.
- (5) Posttussive suction.

Röntgenograms to show single or multiple areas of rarefaction surrounded by dense borders.

7. *Serious complications*.—These should be limited to tuberculous complications affecting any organ tissue to such an extent as to impair seriously local function, as determined by symptoms, and influence unfavorably the prognosis of the case.

UNDER SYMPTOMS

8. *Slight constitutional symptoms*.—Slight impairment of digestion; slight loss of weight, of appetite, of strength; lassitude; nervousness; possibly slight acceleration of pulse and possibly slight elevation of temperature. (See definitions No. 9 and No. 10.) The impairment of health may be hardly apparent objectively or subjectively.

9. *Slight elevation of temperature*.—Maximum temperature after rest for one-half hour seldom over 99.5° by mouth, or 100.5° F. by rectum.

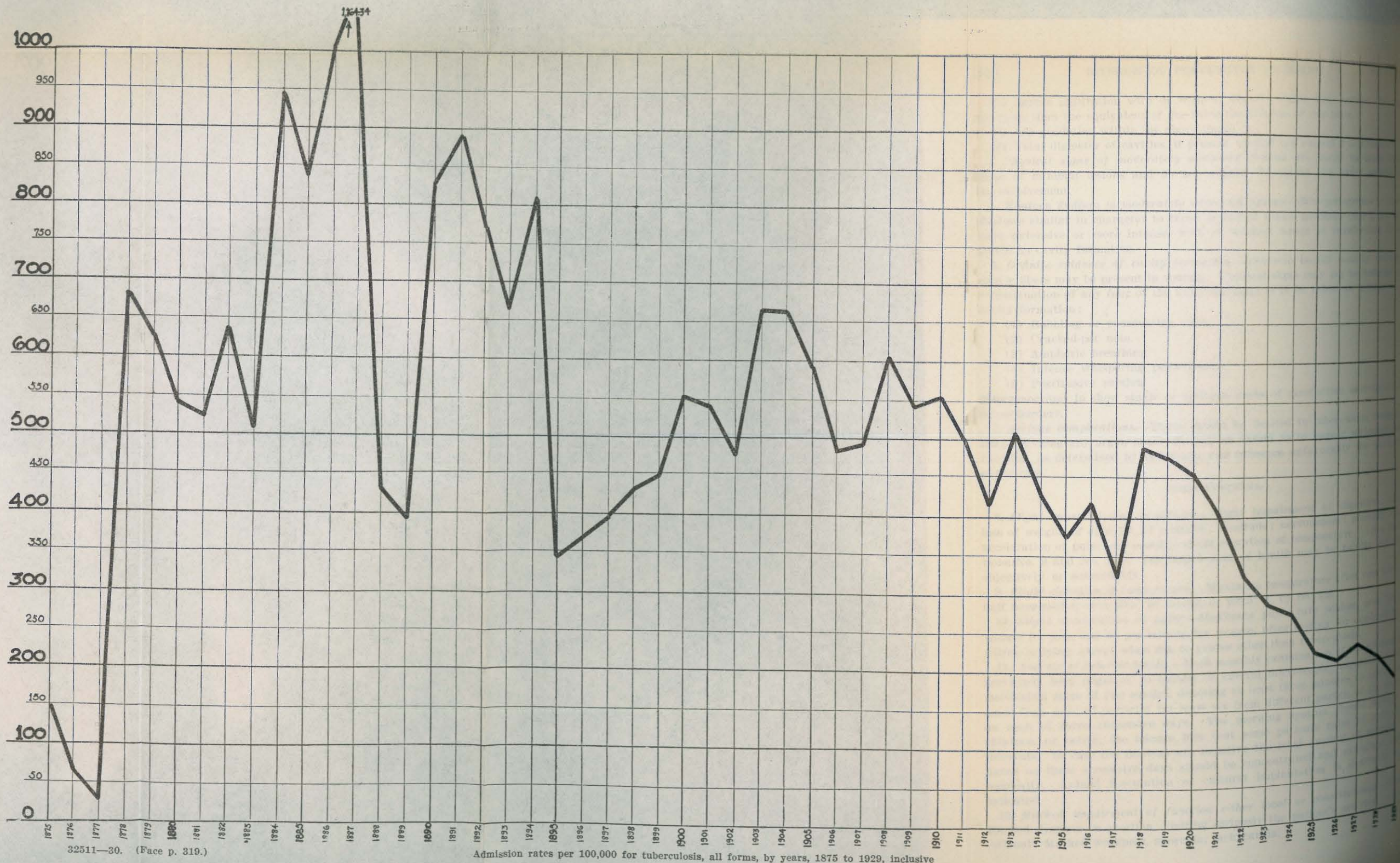
10. *Slight acceleration of pulse*.—Maximum pulse rate seldom over 90 per minute for men and 96 per minute for women, after resting for one-half hour, sitting or lying, except when due to causes other than tuberculosis.

11. *Absence of tubercle bacilli*.—Each monthly examination, if the sputum has previously been negative, to consist of careful microscopic inspection with a mechanical stage of two smears, devoting at least three minutes to each smear made from selected particles (at least six from different parts), of the sputum on each of three successive days. The morning sputum should always be obtained, or better, the minute bits that some patients raise at infrequent intervals. In case the findings are negative the total amount of sputum collected on three successive days should be concentrated and examined microscopically. Animal inoculation or cultural implantation is desirable when indicated.

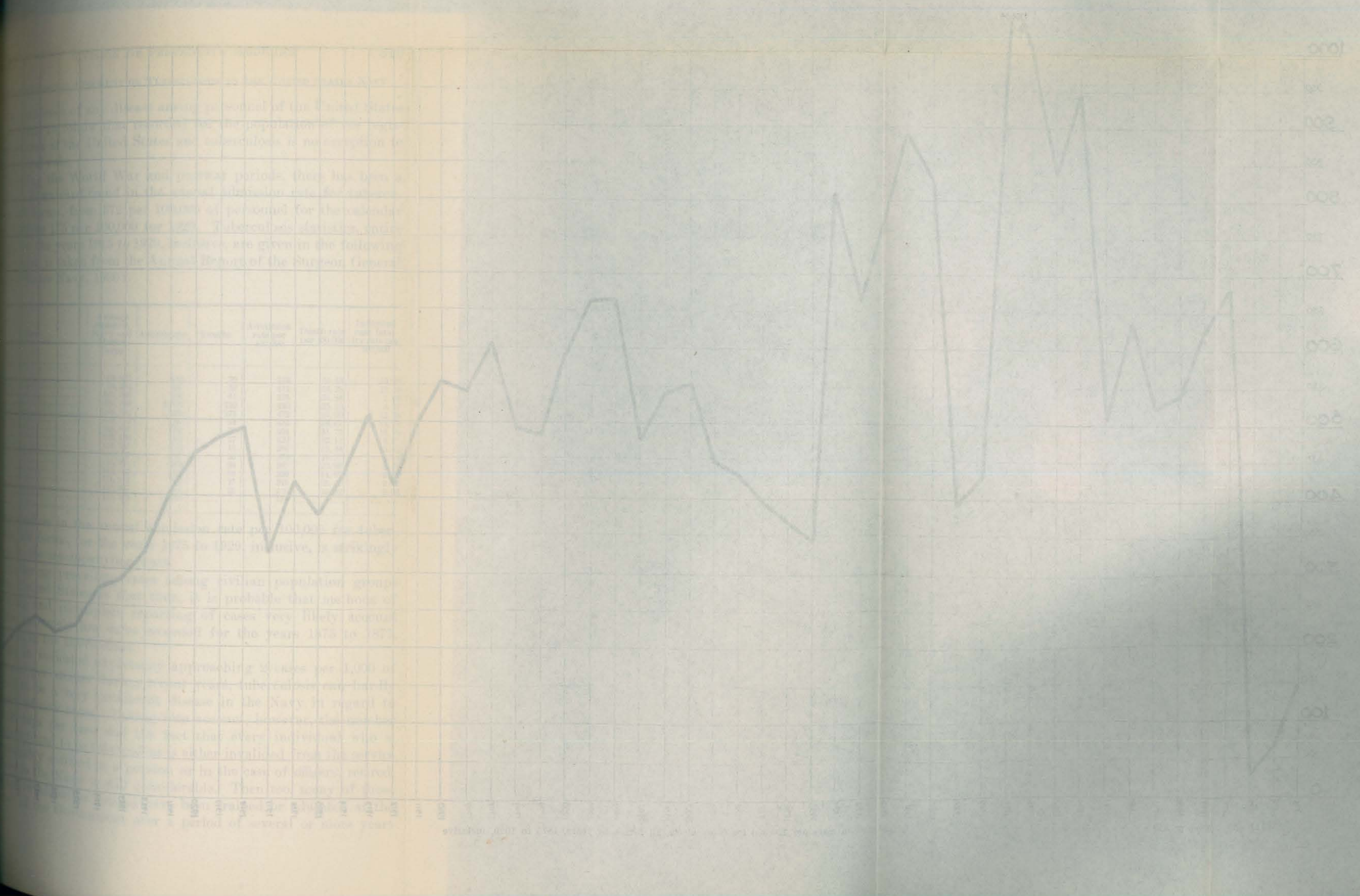
12. *Marked impairment of function either local or constitutional*.—Local: Marked dyspnea on exertion, limiting seriously the patient's activity. Constitutional: Marked weakness, anorexia, tachycardia.

ADMISSION RATES PER 100,000 FOR TUBERCULOSIS, ALL FORMS, BY YEARS

1875 TO 1929, INCLUSIVE.



TUBERCULOSIS, ALL FORMS, BY YEARS 1875 TO 1929 INCLUSIVE



EPIDEMIOLOGICAL COMMENT ON TUBERCULOSIS IN THE UNITED STATES NAVY

The incidence of any disease among personnel of the United States Navy tends to follow that recorded for the population of the registration area of the United States and tuberculosis is no exception to this general rule.

Omitting the World War and postwar periods, there has been a gradual downward trend in the annual admission rate for tuberculosis, all forms, from 372 per 100,000 of personnel for the calendar year 1915 to 175 per 100,000 for 1929. Tuberculosis statistics, entire Navy, for the years 1915 to 1929, inclusive, are given in the following table which is taken from the Annual Report of the Surgeon General United States Navy, 1930:

Year	Average strength, Navy and Marine Corps	Admissions	Deaths	Admission rate per 100,000	Death rate per 100,000	Indicated case fatality rate per 100,000
1915.....	68,075	253	36	372	52.88	10.28
1916.....	69,294	287	39	414	56.28	13.59
1917.....	245,580	796	61	324	24.84	7.66
1918.....	503,792	2,420	130	480	25.80	5.37
1919.....	298,774	1,409	173	472	57.90	12.28
1920.....	140,773	637	84	453	59.67	13.19
1921.....	143,861	602	77	404	51.73	12.79
1922.....	122,126	393	27	322	22.11	6.87
1923.....	116,565	332	18	285	15.44	5.42
1924.....	119,280	327	20	274	16.77	6.12
1925.....	115,391	285	24	247	20.80	8.42
1926.....	113,756	250	16	220	14.07	6.40
1927.....	115,316	287	27	249	23.41	9.41
1928.....	116,047	254	23	219	19.82	9.06
1929.....	117,388	206	-----	175	-----	-----

The decline in the annual admission rate per 100,000 for tuberculosis, all forms, for the years 1875 to 1929, inclusive, is strikingly shown in the accompanying chart.

Considering prevailing rates among civilian population groups in the United States at that time, it is probable that methods of reporting and incomplete reporting of cases very likely account for the extremely low rates recorded for the years 1875 to 1877, inclusive, in the above chart.

With an indicated expectancy approaching 2 cases per 1,000 of personnel per annum during recent years, tuberculosis can hardly be said to be a very prominent disease in the Navy in regard to numbers of new cases. Taking into account, however, the number of sick days per case and the fact that every individual who is definitely found to be tuberculous is either invalided from the service and probably entitled to a pension or in the case of officers, retired, the loss to the Navy is still considerable. Then too, many of those who are invalided or retired have been trained or educated at the expense of the Government over a period of several or more years

and it becomes necessary to dispense with their services at a time when their experience renders them of great value to the Navy.

Considering essential service conditions, it is probable that most of those in the Navy who are found to have active tuberculosis, had the disease in a mildly active or a latent form when they entered the service. Greater care in the examination of applicants by medical officers at recruiting stations would undoubtedly lead, in at least some instances, to the discovery of a presumably tuberculous process and the rejection of the applicant. A history of tuberculosis in the family of the applicant, if obtainable, would be significant in that it would indicate opportunity for previous infection. Röntgenological examination of such applicants would certainly be most desirable.

The following illustrative cases are of those who showed evidence of active tuberculosis within a short time after they enlisted.

Case I: Apprentice seaman, 19 years of age. Length of service, one month. Familial and past history was negative but his home was regarded as the place where infection occurred. Symptoms on admission were thoracic pain, morning cough, weakness, loss of weight, and fever. Sputum was positive for tubercle bacilli. Rales were present. X-ray examination disclosed infiltration at the left apex. There was a bilateral increase of the hilus shadow.

Case II: Private marine, 24 years of age. Length of service, one month. History, family negative, injury of spine at the age of 11 years. Symptoms were not stated. Von Pirquet reaction was positive. Partial destruction of the fifth lumbar vertebra was revealed by X-ray examination. There was fibrosis of the upper lobe right lung.

Case III: Apprentice seaman, 26 years of age. Length of service, one month and four days. Mother died from tuberculosis while he was an infant. First symptoms appeared at the age of 18 years. On admission, he had hemoptysis and night sweats. Tubercle bacilli were found in his sputum. Röntgenograms showed irregular peribronchial thickening and moderate fibrosis of the upper lobe right lung and infiltration upper lobe left lung.

Case IV: Apprentice seaman, 21 years of age. Length of service, two months. An uncle had tuberculosis. Symptoms exhibited were weakness, fever, cough, and loss of weight. His sputum contained tubercle bacilli. X-ray examination disclosed incipient tuberculosis upper lobe, left lung. Apparently no areas of fibrosis or calcification were found.

Case V: Apprentice seaman, 18 years of age. Length of service, five weeks. Family history negative. He was subject to colds. Symptoms were cough, pain left chest, and serofibrinous pleurisy.

X-ray findings were irregular peribronchial thickening and moderate fibrosis of the upper lobe right lung with old infiltration between the second and third ribs and in many scattered areas. The hilum markings were described as dense with calcified spots.

Case VI: Seaman, second class, 29 years of age. Length of service, five months. His brother whom he had not seen for four years was thought to be the source of infection. Symptoms were fever, accelerated pulse, cough, hemoptysis, weakness, and night sweats. Sputum positive. The upper lobe left lung was affected.

Case VII: Fireman, third class, 18 years of age. Length of service, six months. Family and past history negative. Symptoms exhibited were general appearance, fever, night sweats, loss of weight and weakness. Sputum findings were not recorded. A moderately advanced tuberculosis of the upper lobe, right lung, was disclosed on X-ray examination.

Case VIII: Apprentice seaman, 19 years of age. Length of service, seven months. Both father and mother had tuberculosis. Symptoms presented were pain, cough, hemoptysis, and night sweats. Sputum findings were not stated. Spotty infiltration throughout both upper lobes with old infiltration and fibrosis were found on X-ray examination.

Case IX: Ship's cook, first class, 28 years of age. Length of service, one year and four months. History of pleurisy. Family history negative. Symptoms were cough, anorexia, weakness, pain, loss of weight, and hemoptysis. Tubercle bacilli were demonstrated in the sputum. X-ray examination revealed an extensive infiltration involving the entire upper lobe and greater part of lower lobe, left lung. There were a few small areas of old infiltration, slight fibrosis, and several small calcified "spots" in the upper lobe, right lung.

Case X: Chief gunner's mate, 31 years of age. Length of service, 14 years and 1 month. Father died from tuberculosis, mother had active disease which became quiescent. Symptoms were pleurisy and rales. Sputum contained tubercle bacilli. X-ray examination disclosed extensive infiltration and two small cavities upper lobe right lung. Both lungs showed peribronchial thickening with fibrosis and small scattered calcified areas. Calcified areas were also noted in the hilum.

In each of the following two cases, however, X-ray findings were reported as negative. The sputum was positive.

Case I: Apprentice seaman, 19 years of age. Length of service, one month. Family history negative. He had pertussis during

childhood and diphtheria at the age of 14. Symptoms were pleurisy, hemoptysis, accelerated pulse and fever.

Case II: Apprentice seaman, 20 years of age. Length of service, nine months. Family and past history negative. Recorded symptoms were hemoptysis and weakness.

It may be mentioned that many observers no longer regard whooping cough and measles as factors which predispose children to tuberculosis. Hetherington, et al. (24), from a study to determine the prevalence of tuberculous infection among public school children of Philadelphia, found latent apical tuberculosis recognizable in röntgenological films, which they believe is often the precursor of the adult type of pulmonary tuberculosis, in 1 per cent of adolescent children of high-school age. They found latent tuberculosis infiltration of the childhood type in the lungs of more than 1 per cent of the children. This lesion, they believe, may be the precursor of grave disease. They also state that "latent tuberculous foci in lungs and tracheobronchial lymph nodes are found in more than 10 per cent of the school children. It may be the precursor of pulmonary tuberculosis. It varies from massive caseous lesions of serious import to firmly calcified foci, which are evidently healed. Its significance is determined by the size of the lesion, the activity of tuberculin reaction, continued exposure to open tuberculosis, associated changes in the lung substance and the age of the child."

Undoubtedly, in many instances latent tuberculosis or active disease in the early stages can not be detected by even the most careful physical examination. Röntgenological examination with accurate interpretation of films is perhaps the best method of revealing these defects. It would seem desirable to apply this procedure more frequently in those cases in which a familial history of tuberculosis can be elicited and in those presenting any of the symptoms suggestive of tuberculosis, while recruits are at naval training stations and before they have been assimilated into the service. It is quite possible that, in the future, such an examination will be required of all applicants for a commission or even of all recruits. While the expense of such an undertaking would be great, it is conceivable that it would be more than counterbalanced through an actual saving in pensions and in the prevention of disability.

Since January 1, 1928, a questionnaire has been required in the case of every person in the Navy who is admitted to the sick list with tuberculosis. The questionnaire is as follows:

Subject: Questionnaire to be forwarded in every case reported as infection
B. Tuberculosis.

1. The records of the bureau show that the below named man was taken up on the sick list as a on under diagnosis.

2. It is requested that the additional information as outlined below be furnished in this case:

1. Name and rate of patient.
2. Race Total service Years Months.
3. Place of birth Date
4. Place of enlistment Date
5. Type of duty performed in the United States Navy.
6. Health of patient prior to symptoms of tuberculosis.
7. History of tuberculosis in patient's family.
8. History of exposure of patient at any age to tubercular infection.
9. Probable date, place, and source of infection.
10. Approximate date of first symptoms.
11. Clinical and laboratory evidence upon which diagnosis was based.
12. Is there any evidence by X-ray examination of old fibrosis, or calcification, indicative of former lesions? Give findings in detail.
13. Is there any reason to suppose that an active or latent infection existed prior to entry into the United States Naval service?
14. What was the name or the mess number at which the patient ate?
15. Is there any history of contact with previous cases on board?

While the admissions in the Navy for tuberculosis are not greater than for similar groups in civil life, it is thought that many cases are reported as admissions in which there is reasonable evidence to indicate an infection prior to entry into the service. The bureau, therefore, directs that this questionnaire be returned in every case of tubercular infection in order that, in the opinion of the attending medical officer, those patients in whom an active infection existed prior to enlistment, those in whom a latent infection became active due to service conditions, those that acquired a super infection upon an old latent process, and those that acquired a primary infection while in the service may be more truly recorded.

This questionnaire is for statistical purposes only.

When they are received in the bureau the questionnaires are edited, corrected, and the data transferred to cards which are retained for any future study. In many instances the data are very complete and much useful information has been obtained. In other instances they apparently have been filled out so hurriedly that the data are practically valueless or even contradictory. Thus, in one instance it was recorded that a patient who was born in 1901 and who was 26 years of age in 1928, contracted tuberculosis from his mother who died in 1900!

The remainder of this article will be devoted to a tabulation and discussion of the data obtained by the questionnaires.

Family history.—The following is a tabulation of the family history as recorded:

	1928	1929	1930		1928	1929	1930
Negative.....	195	164	34	Aunt.....	2	4	2
Recorded as "yes".....	3	0	0	Uncle.....	2	1	0
Mother.....	5	4	1	Aunt and uncle.....	2	0	0
Father.....	6	4	2	Stepfather.....	1	0	0
Brother.....	2	4	1	Grandmother.....	0	1	0
Sister.....	3	3	2	Grandfather.....	0	0	1
Mother and father.....	2	2	0	Grandfather and uncle.....	1	0	0
Mother and sister.....	5	0	0	Second cousin.....	0	1	0
Mother, sister, and brother.....	0	1	0	Questionable.....	5	1	0
Mother and uncle.....	1	1	0	Unknown.....	8	5	5
Father and sister.....	1	2	0	Not obtainable.....	8	4	0
Father and brother.....	0	1	0				
Father's first wife.....	0	1	0	Total.....	254	206	49
Wife.....	2	2	1				

In 1928, 38, or 15 per cent, of those admitted with tuberculosis gave a history of familial tuberculosis; in 1929, there were 32, or 15.5 per cent; and in 1930, 10, or 20 per cent.

Past history.—Entries regarding the occurrence of other diseases and conditions prior to the onset of active tuberculous disease were rather meager. Those listed in the following table and taken from the histories of patients admitted with tuberculosis in 1928 and 1929 may or may not have had an influence in the development of the disease. Some patients had but one attack of the diseases or conditions listed while others had more than one. Lack of space precludes a detailed description of previous diseases in each individual case. The table is given for what it is worth.

Previous health of patients admitted with tuberculosis in 1928 and 1929

	Prior to 1923	1923	1924	1925	1926	1927	1928	1929	No date given	Total
Influenza.....	¹ 49	8	4	3	4	4	5	1	7	85
Tonsillitis, acute.....	26	4	3	5	5	5	4	2	9	63
Gonorrhea.....	26	5	6	3	6	7	3	1	2	57
Bronchitis, acute.....	20	6	6	3	6	5	2	1	1	50
Catarrhal fever.....	1	0	2	3	10	11	14	1	8	50
Chancroid.....	11	1	3	6	5	5	4	0	3	38
Syphilis.....	9	2	3	3	5	2	3	0	11	38
Mumps.....	7	2	2	0	0	2	0	0	6	19
Pleurisy.....	4	1	0	0	0	3	2	1	7	18
Measles.....	4	3	0	0	0	2	0	0	7	16
Malaria.....	6	0	0	1	2	3	3	1	0	16
Tonsillitis, chronic.....	1	1	1	2	2	4	1	0	4	16
Pneumonia.....	7	0	0	0	1	0	1	0	6	15
Otitis media.....	3	1	2	1	1	1	3	2	0	14
Whooping cough.....	1	0	0	0	0	0	0	0	1	2
Scarlet fever.....	1	0	0	0	1	0	0	0	0	2
Smallpox.....	0	0	0	0	0	1	0	0	1	2

¹Twenty-eight of 49 influenza occurred during epidemic of 1918-19.

Other diseases and conditions were given as follows:

	Total		Total
Frequent colds.....	18	Ulceromembranous angina.....	3
Rheumatism.....	8	Diphtheria.....	2
Gastritis.....	8	Dengue.....	2
Pharyngitis.....	7	Spinal injury.....	2
Fistula in ano.....	6	Rheumatic fever.....	2
Angina, Vincent's.....	6	Appendectomy.....	2
Lymphadenitis.....	5	Sore throat.....	2
Appendicitis.....	5	Asthma.....	2
Cholecystitis.....	4	Osteomyelitis.....	2
Rhinitis.....	4	Sinusitis.....	2
Hemorrhoids.....	4	Nephritis, acute.....	2
Persistent cough.....	4	Myositis, acute.....	2
Pulmonary hemorrhage.....	3	Abscess, peritonsillar.....	2
Occasional colds.....	3	Other miscellaneous diseases	
Cellulitis.....	3	and conditions.....	48
Gastroenteritis.....	3		

Of the 254 patients admitted with tuberculosis in 1928, their previous health was recorded as good or excellent in 76 instances, and of those admitted in 1929, in 74 instances.

Length of service.—It is of interest to note the total length of service rendered by each individual up to the date of first admission to the sick list under the diagnosis of tuberculosis. This is shown in the following table for those admitted during the years 1928 and 1929. Those admitted in 1930, as indicated by the questionnaires received up to June 1, 1930, are also included.

Length of service, tuberculosis (all forms)

	1928	1929	1930		1928	1929	1930
Less than 1 month.....	1	0	0	Between 10 and 11 years.....	9	12	4
Between 1 and 2 months.....	4	0	1	Between 11 and 12 years.....	10	6	1
Between 2 and 3 months.....	3	0	1	Between 12 and 13 years.....	3	12	2
Between 3 and 4 months.....	0	1	0	Between 13 and 14 years.....	9	5	3
Between 4 and 5 months.....	2	1	0	Between 14 and 15 years.....	6	2	2
Between 5 and 6 months.....	2	0	0	Between 15 and 16 years.....	6	1	0
Between 6 and 9 months.....	5	6	0	Between 16 and 17 years.....	0	5	0
Between 9 months and 1 year.....	15	10	0	Between 17 and 18 years.....	4	1	0
Total less than 1 year.....	32	18	2	Between 18 and 19 years.....	3	3	0
Between 1 and 2 years.....	30	17	5	Between 19 and 20 years.....	1	1	1
Between 2 and 3 years.....	22	29	8	Between 20 and 21 years.....	0	0	0
Between 3 and 4 years.....	24	18	8	Between 21 and 22 years.....	0	0	0
Between 4 and 5 years.....	22	6	0	Between 22 and 23 years.....	1	2	0
Between 5 and 6 years.....	17	17	2	Between 23 and 24 years.....	1	0	0
Between 6 and 7 years.....	10	14	2	Over 24 years.....	0	2	0
Between 7 and 8 years.....	14	12	4	Not obtainable.....	3	3	0
Between 8 and 9 years.....	15	11	1				
Between 9 and 10 years.....	12	9	5	Total.....	254	206	50

Underweight or overweight at the time of original enlistment.—Underweight has long been associated with the presence of latent or active tuberculosis, but it is well known that many who develop clinical disease have been well nourished and robust up to the time of its onset. Even some patients with far advanced tuberculosis

have been known to possess a weight which is considered normal for their height and age.

In regard to children, Nelson, Edward, and Myers (1926), from an analysis of 2,000 school children in Minneapolis, found malnutrition in 26 per cent. They believe that poverty, ignorance and disease are the outstanding causes and state "there is no doubt that disease plays a considerable rôle in our group of malnourished children, since many of them presented foci of infection about the teeth and tonsils."

The figures of Chadwick and Zacks (1927) show a higher percentage of tuberculin reactors among underweight children and a higher incidence of malnutrition with hilum tuberculosis in certain age groups, but these figures do not suggest that tuberculosis is responsible for more than a very small percentage of cases of malnutrition. They state that they have no evidence to prove that a malnourished child infected with tubercle bacilli is any more certain to develop tuberculosis than one that is well nourished. Hetherington (1928) from a survey of public school children in Philadelphia reached the following conclusions:

1. Weight below normal is not more frequently found in children in whom latent tuberculous infection is shown by sensitiveness to tuberculin than in those who give no skin reaction.
2. There is no evidence of underweight in children with latent tuberculous nodules of the lungs demonstrated by röntgenograms.
3. In children 1 to 5 per cent underweight, latent tuberculosis of tracheo-bronchial lymph nodes is more common than in other children. Tracheo-bronchial tuberculosis is seldom associated with greater loss of weight, and is probably not its cause.
4. A small group of cases indicates that latent apical tuberculosis of adolescence in some instances causes moderate loss of weight, but the lesion may occur with no loss of weight.
5. Underweight has little if any value in the diagnosis of latent tuberculous infection.

Figures showing the weight recorded upon original entry into the service of those who were admitted with tuberculosis in 1928 and 1929 are given in the following tables:

WEIGHTS, 1928

[In two cases information was not obtainable]

	First enlistment			More than one enlistment		
	Number	Per cent of first enlistment	Per cent of total tuberculosis	Number	Per cent of first enlistment	Per cent of total tuberculosis
According to standard.....	1	0.93	0.39	2	1.39	0.78
Underweight:						
Less than 5 pounds.....	7	6.48	2.76	7	4.86	2.76
5 to 9 pounds.....	24	22.22	9.45	14	9.72	5.51
10 to 14 pounds.....	17	15.74	6.69	18	12.50	7.09
15 to 19 pounds.....	9	8.33	3.54	30	20.83	11.81
20 to 24 pounds.....	8	7.41	3.15	21	14.58	8.27
25 to 29 pounds.....	9	8.33	3.54	22	15.28	8.66
30 to 34 pounds.....				12	8.33	4.72
35 to 39 pounds.....				3	2.08	1.18
Total.....	75	69.44	29.53	129	89.58	50.79

WEIGHTS, 1928—Continued

	First enlistment			More than one enlistment		
	Number	Per cent of first enlistment	Per cent of total tuberculosis	Number	Per cent of first enlistment	Per cent of total tuberculosis
Overweight:						
Less than 5 pounds.....	10	9.26	3.94	8	5.56	3.15
5 to 9 pounds.....	8	7.41	3.15	3	2.08	1.18
10 to 14 pounds.....	6	5.56	2.36	1	.69	.39
15 to 19 pounds.....	4	3.70	1.57	2	1.39	.78
20 to 24 pounds.....	1	.93	.39	1	.69	.39
25 to 29 pounds.....	1	.93	.39	0	0	0
30 to 34 pounds.....	2	1.85	.78	0	0	0
66 pounds.....	1	.93	.39	0	0	0
Total.....	33	30.56	12.99	15	10.42	5.91

WEIGHTS, 1929

[In 16 cases information was not obtainable]

According to standard.....	4	5.40	1.94	1	0.86	0.49
Underweight:						
Less than 5 pounds.....	13	17.57	6.31	10	8.62	4.85
5 to 9 pounds.....	3	4.05	1.46	13	11.21	6.31
10 to 14 pounds.....	19	25.68	9.22	16	13.79	7.77
15 to 19 pounds.....	7	9.46	3.40	26	22.41	12.62
20 to 24 pounds.....	7	9.46	3.40	17	14.66	8.25
25 to 29 pounds.....	2	2.70	.96	7	6.03	3.40
30 to 34 pounds.....				13	11.21	6.31
35 to 39 pounds.....				1	.86	.49
Total.....	55	74.32	26.70	104	89.66	50.49
Overweight:						
Less than 5 pounds.....	4	5.40	1.94	6	5.17	2.91
5 to 9 pounds.....	8	10.81	3.88	4	3.45	1.94
10 to 14 pounds.....	5	6.76	2.43	1	.86	.49
15 to 19 pounds.....	1	1.35	.49	0	0	0
20 to 24 pounds.....	0	0	0	1	.86	.49
25 to 29 pounds.....	1	1.35	.49	0	0	0
Total.....	19	25.68	9.22	12	10.34	5.83

These figures would seem to indicate that underweight at the time of original enlistment has a certain bearing upon the subsequent development of clinical tuberculosis. There is no data, however, to indicate how many men who were underweight when they enlisted did not subsequently develop tuberculosis, certainly a considerable number, and lack of time does not permit further analysis to show how many of these patients gave a history of familial tuberculosis or evidence of an old infection. It may be stated in passing that present instructions do not permit the acceptance of applicants who are more than 15 pounds under the standard weight for their age and height or who are below the minimum standard of 132 pounds.

Circumference of chest.—Similar figures with reference to the circumference of the chest as noted at the time of original entry into the service are given in the two succeeding tables.

1928

[In 2 cases information was not obtainable]

	First enlistment			More than one enlistment		
	Number	Per cent of first enlistment	Per cent of total tuberculosis	Number	Per cent of first enlistment	Per cent of total tuberculosis
According to standard.....	13	12.04	5.12	16	11.11	6.30
Below standard:						
Less than 1 inch.....	16	14.81	6.30	12	8.33	4.72
Between 1 and 2 inches.....	25	25.15	9.84	21	14.58	8.27
Between 2 and 3 inches.....	16	14.81	6.30	30	20.83	11.81
Between 3 and 4 inches.....	9	8.33	3.54	23	15.97	9.06
Between 4 and 5 inches.....	7	6.48	2.76	26	18.06	10.24
Between 5 and 6 inches.....	0	0	0	7	4.86	2.76
Between 6 and 7 inches.....	0	0	0	1	.69	.39
Total.....	86	79.63	33.86	136	94.44	53.54
Above standard:						
Less than 1 inch.....	10	9.26	3.94	1	.69	.39
Between 1 and 2 inches.....	5	4.63	1.97	5	3.47	1.97
Between 2 and 3 inches.....	2	1.85	.79	1	.69	.39
Between 3 and 4 inches.....	4	3.70	1.57	1	.69	.39
Between 4 and 5 inches.....	0	0	0	0	0	0
Between 5 and 6 inches.....	1	.93	.39	0	0	0
Total.....	22	20.37	8.66	8	5.56	3.15

1929

[In 16 cases information was not obtainable]

According to standard.....	7	9.46	3.40	4	3.45	1.94
Below standard:						
Less than 1 inch.....	10	13.51	4.85	12	10.34	5.83
Between 1 and 2 inches.....	25	33.78	12.14	21	18.10	10.19
Between 2 and 3 inches.....	14	18.92	6.80	19	16.38	9.22
Between 3 and 4 inches.....	4	5.41	1.94	16	13.79	7.77
Between 4 and 5 inches.....	2	2.70	.97	24	20.69	11.65
Between 5 and 6 inches.....	1	1.35	.49	8	6.90	3.88
Total.....	63	85.14	30.58	104	89.66	50.49
Above standard:						
Less than 1 inch.....	4	5.41	1.94	4	3.45	1.94
Between 1 and 2 inches.....	4	5.41	1.94	3	2.59	1.46
Between 2 and 3 inches.....	1	1.35	.49	3	2.59	1.46
Between 3 and 4 inches.....	1	1.35	.49	1	.86	.49
Between 4 and 5 inches.....	1	1.35	.49	1	.86	.49
Total.....	11	14.86	5.34	12	10.34	5.83

Laxity in recruiting during the period of the World War undoubtedly account for the acceptance of men who were below the standards for their age and height, both in regard to weight and chest measurements. According to present instructions an applicant will not be accepted whose weight and chest measurements are not proportionate to his height as prescribed in the tables published in the Manual of the Medical Department, United States Navy.

Clinical symptoms.—Listed in the order of frequency, the clinical symptoms observed and reported on the questionnaires are as follows.

Clinical symptoms

	1928	1929	1930	Total
Cough.....	130	136	31	297
Loss of weight.....	125	115	26	266
Fever.....	99	81	22	202
Rales.....	88	89	21	198
Weakness.....	79	68	8	155
Pain.....	46	67	17	130
Hemoptysis.....	59	57	13	129
Night sweats.....	45	69	14	128
Loss of appetite.....	11	17	3	31
Pleurisy.....	16	12	2	30
Shortness of breath.....	1	20	2	23
Headache.....	6	13	2	21
Rapid pulse.....	16	1	0	17
Expectoration.....	5	10	0	15
Hoarseness.....	5	5	3	13
Poorly nourished.....	8	2	0	10
Soreness of throat.....	3	4	3	10
Chills.....	3	4	2	9
Pains in abdomen.....	0	6	1	7
Dizziness.....	1	6	0	7
Laryngitis.....	0	3	3	6
Nervousness.....	3	2	0	5
Symptoms of extra pulmonary lesions.....	5	5	2	12

It should be remarked, however, that in many instances the patients exhibited more than one symptom while in other instances no symptoms were recorded.

Tubercle bacilli.—In most instances stained smears were examined for tubercle bacilli while in a few instances suspected material was injected into laboratory animals. The results were as follows:

	1928	1929	1930	Total
Sputum, positive.....	184	147	36	367
Sputum, negative.....	3	8	1	12
Sputum, not stated.....	61	46	12	119
Cervical lymph nodes.....	3	3	0	6
Pleural exudate.....	1	2	0	3
Cerebrospinal fluid.....	1	0	1	2
Axillary lymph node.....	0	1	0	1
Testicle.....	0	1	0	1
Bone tissue.....	1	0	0	1

Age groups.—The table given below shows the admission rates by age groups for the years 1928 and 1929:

Age group	Officers of the Navy and Marine Corps		Enlisted men of the Navy		Enlisted men of the Marine Corps	
	Annual rate per 1,000		Annual rate per 1,000		Annual rate per 1,000	
	1928	1929	1928	1929	1928	1929
16 to 19.....	0	0	1.11	0.93	0.02	0.97
20 to 24.....	0	1.08	2.10	1.89	1.46	.97
25 to 29.....	1.12	2.45	2.69	2.40	5.28	.84
30 to 34.....	2.44	2.59	3.52	2.16	2.10	3.06
35 to 39.....	2.48	1.10	3.75	2.67	3.25	0
40 to 44.....	2.07	0	2.47	2.28	0	2.77
45 to 49.....	0	0	8.40	5.29	0	0
50 to 54.....	0	6.28	0	8.93	0	0
55 to 59.....	0	0	0	0	0	0
60 to 64.....	0	0	0	0	0	0
65 to 69.....	0	0	0	0	0	0
All ages.....	1.47	1.58	2.38	1.98	1.67	1.05

Occupational groups.—Although there is considerable overlapping of duties, it has been customary in the past to divide naval personnel into several occupational groups. Statistics relative to the various groups are given in the following table:

Occupational group	Admission rate per 1,000 persons in the group, 1928	Admission rate per 1,000 persons in the group, 1929
Officers, Navy and Marine Corps.....	1.29	1.58
Midshipmen.....	1.23	0
Electricians.....	3.85	2.53
Engine-room force.....	3.09	3.00
Fire-room force.....	1.99	1.88
Miscellaneous artificers.....	2.64	2.89
Clerical force.....	3.76	2.53
Culinary force.....	3.42	3.33
Hospital force.....	3.81	3.50
Marines.....	1.72	1.08
Musicians.....	2.34	1.15
Prisoners.....	3.12	1.10
Nurses (female).....	8.21	0
Aviation artificers.....	1.68	1.48
Apprentice seamen.....	.96	0
Ordnance ratings.....	2.07	2.86
Seamen, other than apprentice seamen.....	1.90	1.33

Admission rates are apparently higher for those who habitually work below decks or indoors ashore and lower for those who frequently work in the open air. Seamen and marines are ordinarily more exposed to inclement weather than other groups. Their rates do not appear to be comparatively high. On the other hand, Hospital Corps men seem to be particularly susceptible. It may be assumed that their duties bring them into greater contact with sources of infection, but it may be that they were infected before they entered the service. The following cases admitted in 1928 illustrate this point:

Case I. Pharmacist's mate, second class, 22 years of age. Length of service, four years and two months. X-ray examination revealed infiltration of the right apex with possible cavitation. There was evidence of an old process in the right lung. The sputum contained tubercle bacilli.

Case II. Pharmacist's mate, second class, 26 years of age. Length of service, six years and three months. Röntgenogram disclosed an active process involving the apex, upper and middle lobes of the right lung. Both lungs were described as thickened with dense calcified glands on the right.

Case III. Pharmacist's mate, third class, 20 years of age. There was clouding of both lung fields, increased markings of both upper lobes extending into the right apex, infiltration right apex, and calcified lymph nodes. The location of the latter was not stated.

In one instance a member of the Navy Nurse Corps, who developed tuberculosis in 1928, shared a room on board a hospital ship for

11 months in 1926 with another member of the same corps. The latter subsequently died from tuberculosis. In the former evidence of old fibrosis or calcification was found on X-ray examination. The active disease was attributed to a superinfection. In this connection, Baldwin (18) states that no case of pulmonary tuberculosis has been known to develop among many hundreds of healthy employees at the Trudeau Sanatorium over a period of 45 years, although many advanced cases have been under treatment at that institution during this period. In a follow-up study by Gordon and Cashman (25), of 737 present and former workers in a hospital for diseases of the chest, the incidence of tuberculosis acquired after termination of service was found to be low. According to their estimation it was less than 2 per cent. The above remarks undoubtedly apply to those in occupational groups other than hospital corps.

Location of lesions.—This is shown in the following table:

Location of lesions as revealed by röntgenological examination

	1928	1929	1930
Right lung.....	54	48	14
Apex.....	7	7	3
Upper lobe.....	31	21	2
Middle lobe.....	1	2	0
Lower lobe.....	2	1	0
Apex and hilum.....	0	5	5
Middle and hilum.....	0	1	0
Middle and upper.....	4	3	2
Middle and lower.....	0	1	0
All lobes.....	7	2	1
Section of lung not stated.....	2	5	1
Left lung.....	32	31	7
Apex.....	5	2	2
Upper lobe.....	14	16	2
Lower lobe.....	2	3	1
Upper and lower lobes.....	4	2	0
Apex and hilum.....	4	2	0
Section of lung not stated.....	3	6	2
Both lungs.....	120	100	21
Apices.....	15	12	2
Upper lobes.....	42	31	27
Lower lobes.....	1	2	0
All lobes.....	11	13	0
Right lung and upper left lobe.....	3	2	3
Right lung and lower left lobe.....	2	1	0
Left lung and upper right lobe.....	7	2	0
Left lung and middle right lobe.....	1	2	0
Left lung and lower right lobe.....	1	1	0
Apices and bases.....	1	0	0
Apices and lower left lobe.....	0	1	0
Upper lobes and right middle lobe.....	6	4	0
Upper right and lower left lobes.....	0	0	1
Upper left and right middle lobes.....	2	0	1
Lower lobes and right upper lobe.....	1	0	0
Section of lung not stated.....	27	29	5
Cervical lymph nodes.....	3	2	0
Pleura.....	2	2	3
Kidney.....	2	1	0
Vertebra.....	1	2	1
Meninges and larynx.....	1	0	0
Anal fistula.....	1	0	0
Right ulna.....	1	0	0
Ileac lymph nodes.....	0	1	0

Location of lesions as revealed by röntgenological examination—Continued

	1928	1929	1930
Rectum.....	1	0	0
Dorsum, left foot.....	0	1	0
Cowper's glands.....	1	0	0
Testicle.....	1	0	0
Epididymis.....	1	0	0
Caecum.....	0	1	0
Peritoneum.....	0	1	0
Not stated.....	29	16	4
X-ray negative.....	4	2	0
Total.....	254	208	50

The occurrence of lesions in both lungs in nearly 50 per cent of the cases would seem to indicate that the disease was well advanced before it was recognized. It should be remarked, however, that a considerable period elapsed in many cases between the time the patient was admitted with tuberculosis and the time he reached a hospital, ship, or station where Röntgenological equipment was available.

Type of lesion.—The following table shows the chief lesions divided as to type. In some cases more than one type was present:

	1928	1929	1930		1928	1929	1930
Infiltration.....	86	85	11	Collapse of lung.....	3	4	1
Cavitation.....	59	60	10	Increased lung markings.....	2	0	0
Fibrosis.....	38	65	14	Lung retracted.....	2	0	1
Mottling.....	24	27	8	Pneumothoraces.....	1	3	1
Calcification.....	23	34	18	Perifocal reaction.....	1	2	0
Fibrocaceous.....	26	29	2	Cloudiness, chest.....	1	0	0
Increased density.....	10	8	1	Bronchiectasis.....	1	0	0
Hilus shadow increased.....	12	7	0	Lobar pneumonia.....	1	0	0
Peribronchial thickening.....	9	12	0	Broncho pneumonia.....	1	0	0
Thickened pleura.....	9	34	3	Allergic reaction.....	0	6	0
All pneumonic exudate.....	6	20	0	Acinus exudate.....	0	1	0
Consolidation.....	4	10	4	Emphysema.....	0	1	0
Destruction of vertebra.....	3	3	1	Scarring.....	0	0	1
Fibro and fibrocaceous.....	3	2	0	Extra pulmonary lesion.....	15	11	4
Parenchyma changes.....	3	0	0	X-ray negative.....	7	2	0
Incipient.....	3	4	0	Type not stated.....	48	21	6

Evidence of old lesions was recorded as follows:

	1928	1929	1930
Fibrosis.....	83	70	13
Calcification, lungs or hilum lymph nodes.....	27	31	18
Calcification, inguinal lymph nodes.....	0	1	0
Enlarged hilum lymph nodes.....	14	9	3
None.....	128	97	16
Not stated.....	2	0	0
Total.....	254	208	50

In most instances cases are included in the above table as they were recorded in the questionnaires. In a few instances, however, it was stated there was no evidence of old lesions notwithstanding other statements to the contrary. For instance, Röntgenograms in the case of a seaman, second class, 20 years of age, with 2 years and

1 month service, whose sputum contained tubercle bacilli, showed a moderate degree of old scarring and numerous calcified nodules in and adjacent to both hila. Yet it was stated that there was no evidence of old fibrosis or calcification. This case is included with those showing calcification of the lungs or hilum lymph nodes.

Distribution among forces afloat.—Personnel serving ashore is so frequently in contact with the civilian population that only the distribution of cases among forces afloat has been considered. Admissions were reported by ships for the years 1928 and 1929 as follows:

	1928	1929
BATTLESHIPS		
Arizona.....	1 (CM-3).....	1 (Sea-1); 2 (Off.).
Arkansas.....	2 (CRM); 2 (Sea-2); 4 (EM-3).....	
California.....	2 (MN-1); 10 (F-2).....	
Colorado.....	12 (SK-3).....	8 (Sea-1); 11 (Pvt.).
Florida.....	9 (CMM).....	
Idaho.....	6 (F-3); 12 (Ptr-1).....	7 (Sea-2); 8 (Sea-1); 8 (WT-1).
Maryland.....	1 (Sgt); 2 (GM-1); 5 (Sea-1).....	1 (Sea-2); 3 (Gf); 4 (Sea-2); 12 (MM-1).
Mississippi.....	1 (RM-3).....	10 (Sea-1); 11 (GM-3).
Nevada.....	3 (CMM); 6 (Sea-1); 9 (F-1); 11 (F-3).....	
New Mexico.....	2 (EM-3); 7 (Sea-1); 9 (MM-1).....	2 (F-10); 4 (Matt-3); 9 (Sea-2).
New York.....	4 (RM-3); 6 (CY).....	1 (Eng-2); 3 (GM-1); 3 (RM-3); 4 (SM-2).
Oklahoma.....	2 (Eng-2); 5 (EM-3).....	1 (Eng-2).
Pennsylvania.....	2 (Sea-1); 4 (Sea-1); 5 (F-2).....	
Tennessee.....	2 (F-3); 2 (CBM); 5 (Sea-2).....	1 (Eng-2); 5 (F-3); 5 (CPhm); 7 (Pvt); 8 (F-3).
Texas.....	2 (Cox); 3 (AS); 6 (RM-1); 7 (Sea-2); 8 (Sea-2); 9 (F-2); 9 (Eng-2); 10 (SC-1); 10 (Eng-1); 12 (CQM).....	6 (Off.); 6 (Cox.).
Utah.....	1 (Off.); 4 (Sea-1).....	
West Virginia.....	12 (Sea-2).....	1 (Mus-1); 9 (Bandmaster).
Wyoming.....	3 (CEM); 4 (Sea-2); 9 (Off.); 9 (Sea-1); 11 (Sea-2).....	1 (F-3); 2 (CBM); 5 (Sea-2).
AIRCRAFT CARRIERS		
Langley.....	1 (EM-3); 9 (SF-2).....	
Lexington.....	9 (MM-3).....	5 (Matt-2).
Saratoga.....	2 (Sea-2); 6 (Sea-2); 6 (QM-3).....	1 (Sea-2); 1 (RM-2); 8 (RM-1).
LIGHT CRUISERS		
Cincinnati.....		7 (Sea-2).
Cleveland.....	7 (F-2); 8 (MM-3); 10 (CMM); 12 (Matt-1).....	
Concord.....		8 (C Smth-2).
Marblehead.....		9 (Yeo-2).
Memphis.....		1 (CM-1); 2 (Off.).
Milwaukee.....	12 (WT-2).....	6 (Sea-1); 9 (Sea-2).
Omaha.....	5 (CMM); 6 (Matt-1).....	7 (RM-3).
Pittsburgh.....		4 (CY); 5 (Off. Ck).
Raleigh.....	9 (Bkr-3).....	2 (Matt-3).
Richmond.....	1 (CSM).....	4 (Eng-2).
Trenton.....	2 (WT-2).....	10 (Off.).
DESTROYERS		
Ausburn, Charles.....	5 (Matt-2).....	
Bainbridge.....		3 (Sea-1).
Barry.....	5 (Off. Ck-1).....	
Breck.....	4 (Matt-2).....	
Chase.....		4 (Sea-1).
Coghlan.....	12 (GM-1).....	5 (Sea-2).
Corry.....		6 (F-1); 9 (Off. Ck.-2); 10 (Sea-2).
Farenholt.....	3 (Eng-2); 12 (SC-3).....	
Farragut.....	1 (CPhm).....	
Flusser.....		1 (Off. Ck.-2).
Glimer.....	6 (OS).....	
Hulbert.....	6 (Bmk-2).....	
Humphreys.....	3 (AS).....	
Isherwood.....	10 (Sea-1).....	
Jones, William.....	6 (O. Std.-2).....	
Lamson.....		5 (CPhM).
Lawrence.....	10 (CWT).....	
McFarland.....	1 (WT-1).....	9 (GM-3).
Marcus.....		6 (F-3).

See note at end of table.

	1928	1929
DESTROYERS—contd.		
McCawley.....	2 (MM-2).....	
Moody.....	5 (Sea-2); 10 (Sea-2).....	
Noa.....	1 (BM-2).....	
Osborne.....		12 (MM-1).
Paulding, J. K.....	10 (Off.).....	
Pillsbury.....		4 (CY); 5 (Off. Ck).
Preble.....	3 (Matt-3); 8 (Sea-2); 2 (Matt-3).....	
Putnam.....	10 (Sea-2).....	
Reid.....		6 (TM-1).
Selfridge.....	3 (CSM).....	
Shirk.....	3 (Eng-2); 6 (WT-2).....	
Stoddert.....	5 (TM-3).....	
Sturtevant.....		4 (SK-2).
Sumner.....	4 (Sea-2).....	
Whipple.....	9 (BM-1).....	2 (Off.).
Worden.....		5 (Eng-1).
MINE SWEEPERS		
Brant.....	4 (ChBoat).....	
Brazos.....	10 (Matt-1).....	
Burns.....		3 (Sea-1).
Hart.....	11 (GM-3).....	5 (Sea-2).
Partridge.....	2 (OS-3).....	
Sandpiper.....	1 (F-2).....	
Widgeon.....	1 (ChMach); 9 (RM-1).....	
SUBMARINES		
O-1.....	5 (EM-1).....	
O-9.....		9 (Sea-2).
R-10.....	6 (Off.).....	
R-12.....	4 (MM-1).....	
R-17.....	8 (MM-3).....	
R-18.....		5 (EM-1).
S-18.....	3 (CQM).....	
S-38.....	12 (MM-3).....	
S-41.....		4 (TM-2).
V-1.....	9 (FF).....	
TRANSPORTS		
Chaumont.....	2 (F-3); 4 (Sea-2).....	
Henderson.....	11 (Sea-2).....	4 (Yeo-1); 5 (WT-1); 5 (Eng-2).
Kittery.....	4 (Cpl).....	
Nitro.....		10 (OS-1); 10 (WT-2).
Vega.....		6 (Sea-2).
MISCELLANEOUS		
Altair.....		5 (Sea-1).
Antares.....		2 (Matt-2); 3 (RM-3).
Argonne.....	8 (Off.).....	2 (Off.).
Beanver.....		4 (Sea-2).
Black Hawk.....		6 (CS-2); 7 (SC-3).
Bushnell.....	3 (QM-1).....	1 (Sea-2).
Camden.....	3 (SC-1).....	
Contocook.....		8 (Yeo-2).
Dobbin.....	1 (RM-2); 8 (Bmkr-1); 10 (Mus-1).....	5 (TM-2); 5 (Elec); 6 (Fc-1); 12 (EM-1).
Gannet.....	10 (CQM).....	
General Alava.....	1 (Cox).....	
Gold Star.....	7 (Bkr-2).....	
Grebe.....		10 (Eng-2).
Hannibal.....		9 (Yeo-1).
Helena.....	8 (MM-1); 9 (CBM).....	
Jason.....		1 (QM-1).
Luzon.....		6 (SC-1).
Mayflower.....	12 (Sea-1).....	
Medusa.....	12 (MM-1); 12 (F-3).....	
Melville.....	1 (Mus-2); 4 (F-2); 9 (Matt-3); 10 (F-1).....	
Mercy.....		1 (MM-1); 1 (Eng-2).
Monocacy.....	3 (GM-1).....	
Oglala.....	11 (BM-1).....	
Panay.....		9 (Sea-2).
Pecos.....	3 (Sea-1).....	
Procyon.....		8 (Off. Ck).
Relief.....	12 (CPhM).....	11 (PhM-3).
Rizal.....	12 (Bmkr-1).....	
Vestal.....		12 (CEM).
Vireo.....		9 (OC-3).
Wright.....	7 (RM-2).....	

NOTE.—The figures in the above table refer to the month in which the patient was admitted to the sick list.

It is generally recognized that more than casual contact with an open case of tuberculosis is necessary for infection to occur. As is well known in the Navy, the various divisions, such as the deck division, the engineer's division, etc., are composed of men of similar ratings. For messing purposes, each division is further divided into groups of 20 men each. Meals are served on tables which accommodate 10 men. Because of this arrangement and for other reasons men tend to associate largely with others of like ratings in their own division.

In the foregoing table there appears to be very little epidemiological relationship between one case and another. On board the U. S. S. *California*, in 1928, a machinist's mate, first class, developed tuberculosis in February and a fireman, second class, in October, while no case of the disease occurred on board the following year. In 1928, on board the U. S. S. *Saratoga*, a ship carrying over 2,000 men, a seaman, second class, was admitted in February, another seaman, second class, and a quartermaster, third class, in June, while in 1929 a seaman, second class, and a radio man, second class, were admitted in January, and a radio man, first class, in August. It is not known whether these men were intimately associated with one another. There are more opportunities for frequent and more close contact on board ships carrying a smaller number of men, such as destroyers, mine sweepers, and submarines. In a number of instances one or more cases of tuberculosis were reported by ships in 1928, while none were reported by the same vessels in 1929. There seems to be very little likelihood that one man with an active case of tuberculosis will infect another on board ship under existing service conditions. Then too, it is altogether probable that a man suffering with active tuberculosis will soon be detected by the medical officer of the ship or, in case the man does not seek treatment at the sick bay, the medical officer's attention will be directed to him by interested shipmates who recognize the symptoms of the disease. In any event he undoubtedly will be admitted to the sick list and transferred to hospital comparatively early in the course of the disease.

As stated before, it is not the policy of the Bureau of Medicine and Surgery to return to active duty any patient definitely proved to be tuberculous even though the disease becomes apparently arrested. Experience with tuberculosis in the Navy is similar to that of Hetherington (24) among the school children of Philadelphia. The evidence we have obtained, they write, suggests that tuberculous infection may spread within schools, but under the existing system of medical school inspection this seldom occurs.

SUMMARY AND CONCLUSIONS

According to Opie (29), the latent apical lesions of adolescence are precursors of a large part of the phthisis of early adult life. "Recognition of these latent lesions and the application of well-established procedures to prevent further extension of tuberculous infection promise to become important factors in the control of the disease." Again according to Opie (29), latent apical tuberculosis of the adult type was found in 1 per cent of children, in large part in high-school pupils between the ages of 15 and 18 years. Most of the men in the Navy are in the age groups 16 to 19 and 20 to 24, and most of the recruits are in the same age groups, with more in the former than in the latter. During the seven years 1922 to 1928, inclusive, an average of approximately 22,000 men were accepted for original enlistment each year. Assuming Opie's figure of 1 per cent, which for this purpose is undoubtedly too high, an average of 220 men with latent apical tuberculosis would have been enlisted during each of these years. It is believed that many if not most of those who develop tuberculosis while in the Navy were tuberculous when they enlisted. Greater care in the selection of recruits and more frequent use of roentgenological examination of those from whom a history of familial tuberculosis can be obtained or those who exhibit symptoms suggestive of the disease coupled with the early recognition and segregation of active cases in hospitals will tend to reduce the incidence of tuberculosis in the Navy.

REFERENCES

- (1) Opie: *Am. Rev. Tuber.*, 1927, XVI, 468.
- (2) Chadwick and Zacks: *New Eng. Jour. Med.* 1929, CC, 332.
- (3) Opie, Landis, McPhedran, and Hetherington: *Am. Rev. Tuber.*, 1929, XX, 415.
- (4) Rich and McCordock: *Bull. Johns Hopkins Hosp.*, 1929, XLIV, 325.
- (5) Maximow: *Ziegler's Beitr.*, 1903, XXXIV, 153.
- (6) Unshelm: *J. A. M. A.*, 1930, XCIV, 1453.
- (7) Opie: *Am. Rev. Tuber.*, 1924, X, 249.
- (8) Douglas and Pinner: *Am. Rev. Tuber.*, 1930, XXI, 305.
- (9) Opie: Report, Henry Phipps Institute, 1928, XX, 1.
- (10) McPhedran: Report, Henry Phipps Institute, 1929, XXI, 532.
- (11) Augustine: *Jour. Prevent. Med.*, 1929, III, 121.
- (12) Brown: *Am. Rev. Tuber.*, 1921-22, V, 518.
- (13) Baldwin: *Ibid.*, 1929, XX, 833.
- (14) Brown: *Ibid.*, 1927, XV, 40.
- (15) Baldwin: *Brit. Jour. Tuber.*, 1922, XVI, 120.
- (16) White: *Arch. Path. and Lab. Med.*, 1927, III, 84.
- (17) Petroff et al: *Jour. Immun.*, 1929, XVI, 233.
- (18) Baldwin: *U. S. Vet. Bur. Med. Bull.*, 1930, VI, 1.
- (19) Cain: *J. A. M. A.*, 1929, XCIII, 880.
- (20) Gorter: *J. A. M. A.*, 1930, XCIV, 1275.

- (21) Ople: Bull. N. Y. Tuber. Assn., 1924, V, 1.
- (22) Pinner: Am Rev. Tuber., 1929, February.
- (23) Minnig: J. A. M. A., 1927, 1774.
- (24) Hetherington, McPhedran, Landis, and Ople: Am. Rev. Tuber., 1929, XX, 421.
- (25) Gordon and Cushman: J. A. M. A., 1930, XCIV, 1643.
- (26) Nelson, Edward, and Myers: Amer. Rev. Tuber., 1926, XIV, 448.
- (27) Chadwick and Zacks: J. A. M. A., 1927, IXXXIX, 670.
- (28) Hetherington: Report, Henry Phipps Institute, 1928, XX, 459.
- (29) Ople: Am. Jour. Med. Sci., 1930, CLXXIX, 104.

LEAD POISONING FROM CHIPPING ON THE U. S. S. "ARIZONA"

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Lead poisoning is the commonest occupational disease in industry. During the past century the uses of lead have become manifold and it is estimated that it is used in 150 different industries. In the Navy, lead in the form of red lead is universally used for the priming coat of all surfaces exposed to the weather, and all metal surfaces inside the hull; and lead in the form of white lead for the finishing coats on inner surfaces. There is slight danger of lead poisoning from the fumes which arise during application of these, but a much greater danger during their removal prior to resurfacing. The old paint generally is removed by scraping, wire brushing, or chipping. When chipping is carried on extensively as during a navy yard overhaul or modernization, air hammers generally are used, and in the process of chipping considerable dust is thrown off into the air. The content of lead in this dust must be quite high, as according to the formulæ for the mixing of paint contained in the Manual of the Bureau of Construction and Repair, (1) red lead is composed of approximately 50 per cent of red lead oxide, and common inside paint is composed of approximately 40 per cent of lead carbonate or sulphate.

The three generally recognized avenues of absorption of lead dust are the skin, the respiratory system, and the digestive system. Blumgart has added a fourth, viz., lymphatic or blood stream absorption from the mucous membranes of the nasopharynx (2). It is well known that the hazard of developing lead poisoning is dependent on the dustiness of the atmosphere. Absorption from the skin seems to be negligible except in cases of poisoning from tetraethylchloride. Lead dust may be brought to the mouth on the hands of the worker and swallowed and later dissolved by the gastric juice; or may be inhaled and lodged on the mucous membranes of the nose and throat or carried directly to the bronchioles and alveoli. Lead dust that is swallowed is changed into lead chloride

by the action of the gastric juice, (3) and as such absorbed. Minot (4) however, found that the lead entering the digestive system is either excreted directly in the feces or, after absorption, is caught by the liver and excreted in the bile. The relative amounts that lodge in the nose and nasopharynx and those that reach the lungs were determined by Lehman, Sarto, and Gfrörer (5). They found that in respiration—inhalation dust of a definite lead concentration through the nose and exhaling through the mouth—only 2 per cent was exhaled, 51 per cent became lodged in the nose, and 3 per cent was found in the washings from the mouth. The remaining 44 per cent is lodged in the alveoli.

Blumgart (2) showed that absorption can take place directly from the mucous membranes of the nasopharynx. Working on cats and dogs, he tied off the esophagus and trachea and kept the animals alive by artificial means. Lead dust was then sprayed into the nasopharynx. When the animals died 24 or 36 hours later, lead was found in large amounts in the bones and in lesser amounts in the lungs, trachea and esophagus (below the point of ligation), liver, muscles, and other internal organs. He concludes that absorption must have taken place through the lymphatics or directly into the blood stream. Phagocytosis and direct absorption of dissolved lead particles play an important part in the absorption of lead from the lungs (6).

Aub and his associates (4) have shown that lead is circulated in the blood stream as colloidal triple phosphate and is deposited in the bones as insoluble lead phosphate. The amount in circulation at one time is very minute. The blood of animals fed on lead salts contains only a few thousandths milligrams of lead as long as the animals are in good health. It is excreted in organic combination in the urine and feces, except the small amount that is unabsorbed in the gastrointestinal tract. Lead is absorbed much faster than it is eliminated, causing accumulative amounts to gather in the bones and internal organs.

The amount of lead necessary to produce symptoms of intoxication varies with individual susceptibility, age, sex, and the form of the lead compound. Wright, Sappington, and Rantoul (7), in a study of the relation of chronic lead poisoning to the water supply in Massachusetts, found 14 people who developed symptoms of poisoning after ingesting as little as 0.1 mg. of lead daily over a period of eight and one-fourth years, and that poisoning was quite general if 1.5 mg. was ingested daily. Greenburg (8), in a study of lead poisoning in a storage-battery plant, found it required from one and one-half to two and one-half years' exposure in an atmosphere containing 0.009 mg. of lead per cubic foot to develop symptoms of

poisoning. Legge (9) says that 2 mg. of lead is the smallest amount which, when inhaled as dust or fumes, may in the course of years set up lead poisoning. Oliver (10) quotes Teleky as saying that ingestion of a little more than 1 mg. of lead per day caused clinical plumbism. Knowlton (11) reports a case of lead poisoning from drinking wine which contained 0.7 part of lead per million. Somerville (12), quoted by Mason, states that lead to the extent of 0.25 part per million is sufficient to condemn water for drinking purposes.

There is no definite relation to age or length of exposure, but in general the young are more susceptible than the old and men more than women. Dr. Alice Hamilton (3), quoted by Sir Thomas Oliver, found one white lead worker suffering from colic and neuritis after three days' exposure to lead. Of 120 patients she examined, 8 became ill in less than three weeks after starting work and 36 in less than a month. The degree of exposure seems to be more important than the length of time of exposure.

Lead is deposited chiefly in the skeletal system, but may be found in any of the internal organs. Norris and Gettler (13) found the following distribution of lead in order of amounts in the post-mortem examination of four cases which had died of tetra-ethyl-lead chloride poisoning: Liver, bone marrow, brain, kidney, and lungs. In tetra-ethyl-lead chloride poisoning, the distribution of lead in the organs may be different because of its greater solubility in fats and lipoids than other lead salts. Hamilton, Reznikoff, and Burham (14), in experimenting with animals, using tetra-ethyl-lead chloride, found the following distribution: Bone marrow, intestines, liver, and lungs. Aub and associates (4) found in experimental work on cats, using lead acetate and lead carbonate, that the largest amount of lead was always found in the bones, regardless of which avenue of absorption was used. A smaller amount was found in the soft tissues—liver, muscles, kidney, stomach, intestines, heart, and lungs, and in the bones only traces were found in the marrow. The deposit was in the bone substance proper.

While circulating in the blood stream in the form of colloidal triple phosphate, $\text{Pb}_3(\text{PO}_4)_2$, lead produces toxic effects on the blood and circulatory systems, the liver, the kidneys, the gastrointestinal system, and the nervous and muscular systems. Any condition which favors the deposition of calcium also favors the deposition of lead in the bones; and any condition that tends to upset the acid-base equilibrium of the body tends to liberate lead back into circulation. While lead is being actively absorbed and is circulating in the blood stream, it is always found in all tissues; but as absorption stops, the other tissues give up their lead to the bones so that the percentage in bones progressively increases. Lead that has been deposited in the

bones is inert, but may be brought back into the general circulation and cause acute intoxication several years later by lowered resistance or the development of an acute disease (4).

There is no agreement amongst writers as to the pathology of lead poisoning. Almost every organ in the body has shown some change at autopsy and has at different times been accused of being a specific lesion of lead poisoning. Norris and Gettler state that in postmortem findings in four cases "the striking microscopic features were the intense engorgement with frank hemorrhage of the lungs, general visceral congestion, except for the liver, and congestion of the vessels of the brain with red blood cell thrombi" (13). The only lesions that are universally found are stippling of red blood corpuscles and the lead line on the gums. Legge and Goadby (9) thought that the specific lesion was hemorrhage of the small vessels, but Aub thinks that the hemorrhage may be due to the anemia (4). Although colic is one of the commonest symptoms, no characteristic lesions have ever been described in the intestines.

As individual susceptibility and the degree of exposure to lead varies, a distinction must be made between lead absorption and lead poisoning. It is self-evident that everyone who is exposed to lead will not develop symptoms of poisoning and as lead accumulates slowly there must be a period when the amount absorbed is not yet sufficient to cause symptoms, although some damage has been done to the body. It has been suggested that the term "lead absorption" be used for this condition and that the term "lead poisoning" be employed only in those cases showing clinical symptoms. Mayers (15) regards all cases of men who have been exposed to lead and show either objective or subjective symptoms or signs as cases of lead absorption, and reserves the term lead poisoning for those that have clinical symptoms. Some men who have a well-marked lead line and stippled cells have no clinical symptoms, while others showing neither a lead line or stippled cells complain of severe colic. The classification of one as a case of lead absorption and the other as lead poisoning seems a differentiation which is made more by the patient than by the doctor. A reasonable amount of judgment must be used by the latter, however, in correlating the clinical symptoms with the laboratory and physical findings in making a diagnosis.

During the months of November and December, 1929, there were 15 cases of lead poisoning aboard the U. S. S. *Arizona* incident to the chipping of painted and red-leaded surfaces. Chipping was begun on a small scale in March, 1929, while the ship was at Guantanamo Bay, and on an extensive scale when the ship arrived at the Norfolk Navy Yard for modernization in May, 1929. From July

until November, the work of the crew consisted largely of chipping and to a lesser extent in red-leading. The deck force worked mostly in large open compartments; the engineering force in smaller compartments, many in double bottoms which measure about 32 feet long, 32 feet wide, and 4 feet high and which are divided into about 36 pockets connected with one another through lightening holes in the ship's structure. These compartments are closed on all four sides, the only access being through two small manholes.

The first case appeared on November 6, 1929. During the remainder of the month, there were 11 admissions; in December, 4. Six cases were of moderate severity, the remaining 9 were quite mild, requiring only a few days on the sick list. Beside the fifteen admissions, a smaller number of cases which were classed as cases of lead absorption were given treatment and excused from further chipping without being admitted to the sick list.

Although the application of red lead was being carried on at the same time, its relation to the development of symptoms is not considered important. It is interesting to note that during this same time chipping was being carried on in the water and fuel tanks which are coated with bitumastic instead of red lead and that no symptoms of any kind developed among these workers.

A list of illustrative cases with brief notes of the symptoms and clinical course is as follows:

Case No. 1, November 6, 1929. H. H., F. lc., age 25.—Complains of crampy pains in abdomen, nausea, anorexia, weakness, and loss of 18 pounds of weight. Has been chipping in double bottoms for one month. Examination: T. 101; P. 90; B. P. 95/60. Marked pallor of face, extensive lead line around gums, active reflexes, abdomen tender and spastic. Blood examination: Hemoglobin, 70 per cent; red blood cells, 3,356,000; white blood cells, 5,600. Blood smear stained with Wright's stain shows many stippled cells, anisocytosis, poikilocytosis, polychromatophilia, and a few nucleated red blood cells. Blood smear stained with dilute solution of methylene blue, according to McCord's technic¹ (16) shows about 15 basophilic cells per field. Reticulated cell count, 150,000. Microscopic examination of urinary sediment shows many red blood cells. Treatment: Put on calcium medication with high calcium diet. November 15, acute symptoms have subsided; put on ammonium chloride medication. November 23, improving slowly; put on phosphoric acid medication. December 9, feels well, color good, B. P. 102/50. To duty under treatment. Sick days, 33.

Case No. 2, November 7, 1929. C. L. C., F. lc., age 25.—Complains of crampy pains in abdomen, nausea, vomiting, constipation, anorexia, weakness, and rheumatic pains in back and joints. Has been chipping for two months, mostly in double bottoms. Examination: T. 98; P. 90; B. P. 84/62. There is marked pallor of the mucous membranes and face, with icteric tint to sclerae, marked lead line around gum margins, coarse tremor of tongue, reflexes normal. Blood examination: Hemoglobin, 70 per cent; red blood-cell count, 3,180,000; white

¹ This technic consists of staining an ordinary blood smear with a dilute acidified solution of methylene blue in hypotonic saline. Stain for 10 minutes, then wash excess stain off. The basophilic substance appears as heavy dots or chains.

blood-cell count, 5,400; differential count, polymorphonuclears, 75 per cent; mononuclears 24 per cent. Wright's stain shows many stippled cells, anisocytosis, poikilocytosis, polychromatophilia, and a few nucleated red blood cells. Methylene blue stain shows about 15 basophilic cells per field. Microscopic examination of urinary sediment shows some hyaline casts, red blood cells, and a few epithelial cells. Placed on calcium medication with high calcium diet. November 14, acute symptoms have subsided; put on ammonium chloride medication. November 20, acute symptoms with colic, nausea, and vomiting have returned; put back on calcium medication. Red blood cells show increased resistance to hypotonic solutions of sodium chloride. No hemolysis in dilutions down to 0.23 per cent in one hour's time. November 25, acute symptoms have subsided; transferred to United States Naval Hospital, Portsmouth, Va., for further convalescence. Examination there showed B. P. 118/70; red blood cell count, 3,470,000; white blood count, 5,650; hemoglobin, 65 per cent; differential count polymorphonuclears, 72 per cent; mononuclears, 28 per cent. Urine negative for lead. While under treatment at the hospital a 4 plus Kahn was discovered; patient denied any knowledge of a primary lesion. Given mixed treatment for leucic condition, improved slowly under calcium medication. Returned to duty January 7, 1930. Number of sick days, 61.

Case No. 3, November 8, 1929. G. V. E., F. 2c., age 22.—Complains of colic, constipation, anorexia, and weakness. Has lost 16 pounds weight. Has been chipping in double bottoms the past month. Examination: T. 98; P. 90; B. P. 100/50. Heavy lead line around gum margins, reflexes normal. Blood examination: Hemoglobin, 80 per cent; red blood-cell count, 3,552,000; white blood-cell count, 8,600; differential count, polymorphonuclears 72 per cent; mononuclears 28 per cent. Wright's stain shows many stippled cells, a few nucleated red cells, anisocytosis, poikilocytosis, and polychromatophilia. Stained with methylene blue blood smear shows about 8 basophilic cells per field. Urine contains a heavy precipitate of albumin. Put on calcium medication with high calcium diet. November 16, acute symptoms have subsided; urine negative. Treatment changed to ammonium chloride. November 30, shows great improvement; to duty under treatment. Number of sick days, 22.

Case No. 4, November 8, 1929. L. B., F. 1c., age 23.—Complains of colic, nausea, vomiting, weakness, anorexia, and rheumatic pains in small of back and legs. Has lost 19 pounds in weight. Has been chipping the past two months, most of the time in double bottoms. Examination: T. 98.6; P. 60; B. P. 103/60. Marked pallor of face, icteric tint of sclerae, heavy lead line around gum margins, apex beat very loud and slapping with soft systolic and diastolic murmurs, abdomen tender and spastic to palpation. Blood examination: Hemoglobin, 70 per cent; red blood-cell count, 3,840,000; white blood-cell count, 8,000; differential count, polymorphonuclears 68 per cent; mononuclears 32 per cent. Smear stained with Wright's stain shows many stippled cells, anisocytosis, poikilocytosis, and polychromatophilia; stained with methylene blue shows about 12 basophilic cells per field. Urine shows numerous red blood cells and a few hyaline casts. Put on calcium medication with high calcium diet. November 15, acute symptoms have subsided, treatment changed to ammonium chloride. Blood pressure 80/60. November 23, improving; treatment changed to phosphoric acid. December 2, shows great improvement; to duty under treatment. Number of sick days, 24. January 10, 1930, hemoglobin, 80 per cent; red blood count, 4,600,000. Wright's stain shows no stippled cells; methylene blue stain shows about 4 basophilic cells per field, lead line present.

Case No. 5, November 8, 1929. O. O. S., Sea. 1c., age 22.—Complains of severe crampy pains in abdomen, with nausea and vomiting. Felt well yester-

day. Has been chipping in open spaces below decks the past three weeks. Bowels are open. Examination: T. 98.8; P. 90; B. P. 128/80. No lead line; abdomen very tender and spastic throughout, face flushed. Blood examination: Hemoglobin, 85 per cent; red blood cell count, 5,536,000; white blood cell count, 6,000; differential—polymorphonuclears, 61 per cent; mononuclears, 39 per cent. Smears stained with Wright's stain shows no stippled cells; with methylene blue shows a few basophilic cells. Put on high calcium diet with calcium medication. November 12, colic and nausea have disappeared; treatment changed to ammonium chloride. November 16, to duty, under treatment. Number of sick days, 10.

Case 7, November 14, 1920. C. C. R., Sea. 2c., age 20.—Complains of colic, nausea, and constipation. Has been chipping the past six weeks, most of the time in confined spaces. Examination: T. 98.6; P. 70; B. P. 114/50, marked lead line around gums, pallor of face, icteric tint of scleræ, normal reflexes, 10 pound loss of weight in the past month. Blood examination: Hemoglobin, 80 per cent; red blood count, 4,000,000; white blood count not made; slide shows stippled cells. Placed on calcium treatment with high calcium diet. November 18, acute symptoms have subsided; placed on ammonium chloride treatment. November 20, acute symptoms with colic, nausea, and vomiting have returned. Ammonium chloride discontinued; put back on calcium treatment. November 23, unable to retain food because of nausea and vomiting. One gram of sodium thiosulphate given intravenously. Fragility test done. At 30 minutes there is no hemolysis in 0.28 per cent saline. At 60 minutes there is slight hemolysis in this tube, but in none of the others of higher concentration. November 30, B. P. 94/20; acute symptoms have subsided. December 9, feels perfectly well; B. P. 110/20; color still poor. To duty under treatment. Number of sick days, 25.

All the men who were removed from the sick list were given light work for several weeks before returning to their regular work and were not allowed to do any further chipping.

The earliest symptoms to be described by most patients were anorexia and weakness. As the absorption of lead continued, colic was soon noticed and was followed by a train of other symptoms. In most cases no symptoms were noticed until the exposure to lead had been for one month or longer. The average length of exposure of the men in the engineering divisions who had been chipping in the double bottoms was much less than that of the men in the deck force who had been chipping in large compartments where ventilation was much better. During the time chipping was in progress in the double bottoms, it was the general practice to have two men in each pocket of the compartment. The narrow measurements and construction of each pocket are given above. Needless to say, shortly after work was begun, the atmosphere was filled with dust. The shortest exposure was Case No. 8, in which symptoms followed after chipping in one of the stern tubes² for only two weeks. Two men work in a tube at the same time and six of those who chipped

² The stern tubes are the channels through which the propeller shafts run and are about 40 feet long and about 2 feet in diameter.

in the tubes were examined and closely questioned as to whether they had any symptoms which could be traceable to lead poisoning. One had a slight headache with a beginning lead line, a second complained of weakness, anorexia, and pains in his chest and had a well-marked lead line. Neither of the men was sick enough to be admitted to the sick list, but both were classed as cases of lead absorption and placed under treatment and relieved from further chipping. In every case blood smears showed a number of basophilic cells, varying from one or two to five or six in each field. These men had worn respirators only part of the time, but when the first case was recognized November 6, all chippers were required to use this protective device constantly.

The outstanding symptom was colic, which in many cases was accompanied by nausea and vomiting. Almost always the colic was preceded by loss of appetite. The colic varied from slight distress to pain which was so severe that it doubled up the patient. The severest attack of colic was in case No. 5, in which the colic came on overnight with no prodromal symptoms. It is worth comment that this patient had had a very slight exposure to lead and had neither a lead line nor stippled cells. The pain generally seemed to be centered in the midline either above or below the umbilicus, which is the location characteristic of pain of small bowel origin. It was said by many to be worse at night than during the day, and was complained of even though not accompanied by constipation. There have been many theories advanced to explain the cause of colic. It is not due to constipation as it is found in cases that have a diarrhea. It is probably due to spasm of the smooth muscle of the small bowel (4). Colic was present in 13 of the 15 cases.

A prominent first sign in the severe cases was a pallor of the face which was out of proportion to that which would be expected from the hemoglobin and red blood cell determination. It is of a peculiar ashy gray shade.

A systolic blood pressure below 100 millimeters was a common finding in the severe cases and was noted in those with a cachexia and loss of weight. In one case it dropped as low as 80/60 and in another 84/62. As the lead cachexia disappeared, the systolic pressure gradually came back to normal.

In the severe cases there was a loss of from 15 to 20 pounds of weight. This was found in those who had other marked symptoms of intoxication—low blood pressure, marked pallor, anemia, anorexia. Weight was put on slowly while the patient was being delead.

In the severe cases the blood showed a secondary anemia with lowered hemoglobin and a decreased number of red blood cells, with evidence of degeneration and regeneration—anisocytosis, poi-

kilocytosis, polychromatophilia, basophilic stippling, and normoblasts. The hemoglobin seldom drops below 70 per cent or the red blood count below 3,000,000. The commonest blood finding was basophilic stippling. Only a few cells show stippling when stained with Wright's stain, but when stained with a dilute solution of methylene blue in hypotonic saline according to the technic of McCord (16) many more show this stippling. In this technic the cell is hemolyzed, leaving only the rim of the cell with basophilic substance within. The exact nature of basophilic substance is unknown but it is a characteristic of young erythrocytes (17). The term "stippled cells" is used to denote those cells that show punctate stippling when stained with Wright's stain, and the term "basophilic cells" to denote those that contain basophilic substance when stained with a dilute solution of methylene blue. In this series of cases smears were stained with both dyes. Only five cases showed stippled cells, but in some cases nucleated red blood cells were found, which also were stippled. Using methylene blue stain, every case showed basophilic cells varying from 15 or 20 per high-powered field to 1 or 2 in every other field. Mild cases gave the latter count. McCord (16) states that by this method of staining a normal person shows only one or two basophilic cells in an entire slide.

In four cases a test was done to determine the osmotic resistance of the red blood cells. The technic of Griffin and Sanford as described by Stitt (18) was followed, using 10 tubes of saline with dilutions ranging from 0.28 per cent to 0.44 per cent. Normal red blood cells are completely hemolyzed in dilutions of 0.32 per cent saline. Aub and Reznikoff (19) found that solutions of lead in vitro as well as in vivo increase the cellular resistance of red blood cells so that they can stand greater reductions in osmotic pressure than normal cells, but that it increases their fragility. Their explanation for this phenomenon is that a precipitate of lead phosphate forms on the surface of the cell membrane making it less permeable and elastic and thus more fragile. Three cases showed an increase in the power of cells to withstand solutions of lowered osmotic pressure. There was no hemolysis in dilutions of 0.28 per cent saline in 30 minutes, and only slight hemolysis in this dilution in one hour, and no hemolysis in the tubes of higher concentration. (See Table 2.) The blood in the fourth case was taken from the only patient who showed marked jaundice. The red blood cells in this case showed hemolysis in the tubes containing 0.28 per cent, 0.30 per cent, and 0.32 per cent saline, which were the same tubes that showed hemolysis in the normal control. Aub and Reznikoff (4) attempt to explain the anemia in lead poisoning on the ground that the lead in circulation makes

the cells more fragile, causing them to break up in the blood stream from the trauma of circulation.

No attempt was made to find lead in the urine or feces owing to the technical difficulties. Kehoe and Thamann (20) state that lead is normally excreted in small amounts in both the feces and urine of persons who are not exposed to lead. They found traces of lead in the urine and feces of 59 medical students and 71 workmen who had no industrial exposure to lead, and conclude that the crude qualitative tests to find lead in the excretions of patients with lead poisoning is of no value.

In one case there was a heavy precipitate of albumin, in six the urinary sediment showed red blood cells and casts which disappeared as the symptoms of intoxication lessened.

Other symptoms were rheumatic pains in the back and joints, pains in the chest, weakness, malaise, headache, vertigo, and insomnia.

Treatment.—The treatment recommended by Aub (4) was used. During the acute stage, the patients were put on a high calcium diet which consisted mostly of milk containing lime water, supplemented with calcium medication. This causes the lead in circulation as colloidal triple phosphate to be deposited in the bones as inert insoluble lead phosphate. Colic usually disappeared after two or three days of this treatment. When the acute symptoms—colic, nausea, and vomiting—subsided, deleading was accomplished by producing an acidosis which liberates lead from the bones into the circulation. Ammonium chloride and phosphoric acid were used; Aub has shown that they triple the excretion of lead. Care must be taken not to delead the patients too rapidly. Two patients developed acute symptoms while being deleading presumably because of too rapid liberation of lead into the blood stream. One was given one gram of sodium thiosulphate intravenously, which relieved the colic in a few hours' time; the other was put back on calcium treatment. Magnesium sulphate was used as a purge.

Preventive measures.—As soon as the first case was recognized the executive officer was notified and the following preventive measures were put into effect: All men who were chipping were ordered to wear respirators at all times during working hours. The men were informed of the danger of lead poisoning and were instructed to wear gloves during working hours, to wash their hands and faces thoroughly before eating, to change clothes after working hours, and to take a bath daily. The crew working in the double bottoms was divided into two sections which chipped on alternate weeks, so that one man never worked in a closed compartment for any longer than one week at a time and no man was allowed to chip for any longer than one month. The men were frequently examined by the medical officer, and any with beginning symptoms of poisoning were relieved

from further chipping. Cases continued to develop until the latter part of December from accumulated amounts absorbed prior to the inauguration of these preventive measures. Then the preventive measures began to show their effect and the cases became fewer and milder, as will be noticed by reference to Table 1.

The respirator used was the standard type adopted by the Navy Department according to Specifications 37R1, February 1, 1927. It consists of a dust-tight face piece made of soft rubber which completely covers the mouth and nostrils of the wearer, with a metal dust filter compartment and outlet valves. The filter material is a thin disc of compressed cotton. The outlet valves prevent the entrance of air on inhalation and allow free egress of air on exhalation. The respirator is held in place by an adjustable elastic band.

Inasmuch as lead poisoning from chipping is almost always due to inhalation of lead dust, any preventive measures must be designed to keep down dustiness or to prevent dust from being absorbed. In the average work in the Navy, and unless chipping is carried on extensively, there is little danger of much absorption through the digestive system of lead that is carried to the mouth on the hands of the worker. It is questionable if lead poisoning ever develops from chipping carried on in open air. McNair and Price (21), in studying the dusts that arise from chipping and wire brushing red-lead surfaces, state that "Dry wire brushing and other dry processes carried on in the open may be regarded as safe, the total inhalation per day not being likely to be dangerous. In the case of dry wire brushing being carried on indoors, the amount of lead inhaled during quite a short spell is likely to exceed the amount which could safely be absorbed daily. The same applies, though to a less degree, with regard to wire brushing carried on out of doors but under cover. Chipping or scraping are probably less dangerous than wire brushing." They found, after wire brushing a rolled steel joist indoors that the content of lead dust in the air inhaled during one hour was 9.4 milligrams; while after chipping the content of lead dust in the air inhaled per hour was 5.7 milligrams.

A study was made of the danger of lead absorption from chipping bulkheads and overheads in compartments below decks, where much of the work of chipping was being carried on. It is well recognized that there is great danger of lead poisoning from chipping in closed compartments such as double bottoms, so no attempt was made to determine the amounts of dust that arise in them.

For the purpose of the study, fresh filters were put in the respirators of eight men before chipping was begun in the morning and collected at the end of working hours. The amount of dust on the filters would represent roughly the amount that could be inhaled during

one working day and gives a direct and comparative reading for the two fields. Four of the men were assigned to overhead chipping in the fireroom and four to chipping bulkheads in the crew's living space. The difference in hazard attached to the two fields lies in the fact that in one the dust falls into the face and in the other it falls past the face of the worker. An average of 29 milligrams of lead expressed as basic lead sulphate was found on the filters of the overhead chippers and an average of 2 milligrams on the filters of the bulkhead chippers. The quantitative analyses were done by the civilian chemist attached to the Norfolk Navy Yard.

Referring to observations previously cited, as only 2 per cent of inhaled lead dust is exhaled, the remaining amount lodging either in the nasopharynx or respiratory tract proper, and as absorption takes place directly from the nasopharynx, either through the lymphatics or directly into the blood stream, and is not conditional upon lead in the lungs, and as the inhalation of but 2 milligrams of lead as dust or fumes in the course of years may produce poisoning, it would seem that there is a definite danger even from chipping bulkheads if carried on for a considerable period of time. The hazard in chipping overhead surfaces is much greater. In closed compartments, such as double bottoms, the conditions are favorable to extreme concentration of lead dust and poisoning is almost certain to develop from chipping unless adequate ventilating arrangements are made and other preventive measures employed.

TABLE 1.—Table showing relation between blood findings, lead line, loss of weight, and blood pressure

Case No.	Sick days	Number of basophilic cells per field	Stippled cells	Lead line	Hg., per cent	R. B. C.	W. B. C.	Differential		Loss of weight, pounds	B. P.
								Polymorphonuclear per cent	Mononuclear per cent		
1.....	33	15	Yes.	Yes.	70	3,356,000	5,600	70	30	18	95/62.
2.....	61	15	Yes.	Yes.	70	3,180,000	5,400	76	24	13	84/62.
3.....	22	8	Yes.	Yes.	80	3,552,000	8,600	72	28	16	100/50
4.....	24	12	Yes.	Yes.	70	3,840,000	8,000	68	32	19	102/60.
5.....	10	1	No.	No.	85	5,536,000	6,000	61	39	0	128/60
6.....	9	4	Yes.	Yes.	80	4,490,000	6,500	57	43	0	115/60.
7.....	25	6	Yes.	Yes.	80	4,400,000	-----	-----	-----	10	94/60
8.....	10	4	No.	Yes.	80	3,540,000	10,000	-----	-----	0	160/70.
9.....	12	5	No.	No.	95	4,500,000	-----	-----	-----	10	135/80.
10.....	11	4	No.	No.	80	3,016,000	6,300	77	23	14	92/64
11.....	7	3	No.	Yes.	85	4,656,000	9,800	69	31	0	132/82.
12.....	5	1	No.	No.	100	6,500,000	-----	-----	-----	0	100/80
13.....	4	1	No.	No.	90	5,184,000	-----	-----	-----	0	108/60.
14.....	6	2	No.	No.	-----	-----	-----	-----	-----	0	118/70.
15.....	3	2	No.	No.	-----	-----	-----	-----	-----	0	124/86.

TABLE 2.—Table showing increased resistance to osmosis

	Time	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44
J. R. L.....	30 minutes.....	X	X	X						
	60 minutes.....	X	X	X	X					
H. H.....	30 minutes.....	X								
	60 minutes.....	X								
C. L. C.....	30 minutes.....	None.								
	60 minutes.....	None.								
C. C. R.....	30 minutes.....	None.								
	60 minutes.....	Slight.								
Normal.....	30 minutes.....	X	X	X						
	60 minutes.....	X	X	X	X					

X indicates hemolysis.

BIBLIOGRAPHY

- (1) Manual of C. and R. Department, U. S. Navy.
- (2) Herman L. Blumgart: Lead Studies VI. Absorption of Lead by the Upper Respiratory Passages. The Journal of Industrial Hygiene. September, 1923, Vol. V, No. 5.
- (3) Sir Thomas Oliver in Kaber and Hayhurst: Industrial Health, P. Blakiston's, Philadelphia, 1924.
- (4) Aub, Fairhall, Minot, and Reznikoff: Lead Poisoning. Williams and Wilkins, Baltimore, 1926.
- (5) Lehman, H. B., Sarto, Y., and Gfrorer, W., Uber die Quantitative Absorption von Staub Aus der Luft durch des Menschen. Arch. F. Hyg. 1912, 75, 152.
- (6) Fine, J. J.: The Phagocytosis of Lead Compounds and their Influence on the Activity of the Leukocyte. Journal Industrial Hygiene; 1923, V. 138.
- (7) Wright, W., Sappington, C. O., and Rantoul, E.: Lead Poisoning from Lead in Piped Water Supplies. Journal Industrial Hygiene, September, 1928.
- (8) Greenburg, L.: A Study of Lead Poisoning in a Storage-Battery Plant. Public Health Bull., July 12, 1929.
- (9) Legge, T. M., and Goadby, K. W.: Bleivergiftung und Bleiaufnahme. Julius Springer, Berlin, 1921.
- (10) Sir Thomas Oliver: Lead Poisoning. London, New York, 1914.
- (11) Knowlton, M.: Lead Poisoning from Wine, J. A. M. A., Dec. 15, 1928, Vol. 91.
- (12) Mason, W. P.: Examination of Water. Wiley & Sons, New York, 1917.
- (13) Norris, C., and Gettler, A. O.: Poisoning by Tetra-Ethyl-Lead. Post-mortem and Chemical Findings, J. A. M. A., Sept. 12, 1925, Vol. 85.
- (14) Hamilton, A., Reznikoff, P., and Burnham, G.: Tetra-Ethyl Lead, J. A. M. A., May 16, 1925, Vol. 84.
- (15) Mayers, M. R.: Lead Absorption and Compensation. Journal Industrial Hygiene, April, 1929.
- (16) McCord, C. P.: A New Test for Industrial Lead Poisoning. Bull. of U. S. Bureau of Labor Statistics No. 460, April, 1928.
- (17) Keys, J. A.: Quoted by McCord.
- (18) Stitt, E. R.: Practical Bacteriology, Blood Work, and Animal Parasitology, P. Blakiston's Son and Co., Philadelphia, 1923.
- (19) Aub, J. C., and Reznikoff, P.: The Effects of Lead on Red Blood Cells, The Journal of Exper. Med., Vol. XL, pp. 151-208.

(20) Kehoe, R. A., and Thamann, F.: The Excretion of Lead. *J. A. M. A.*, April, 1929, Vol. 92.

(21) McNair, L. C., and Price, C. W.: The Effect of Rubbing Down and Scraping by Dry Process of Lead-Painted Surfaces of Iron and Steel Structures, *The Journal of Industrial Hygiene*, Vol. XI, No. 6, June, 1929.

HEALTH OF THE NAVY

The general admission rate, based on statistical returns for diseases and injuries occurring in July, August, and September, 1930, was 452 per 1,000 per annum. The corresponding rate for the first quarter of the year was 419 and for the second quarter 606. Based on experiences in the recent years, the expected rate from all causes for the third quarter would be 540 per 1,000. The admission rate for this quarter is slightly lower than the expected rate due to a decrease in the number of admissions for communicable diseases.

The admission rate from diseases was 397 per 1,000 per annum, as compared with 470, the median rate for the corresponding three months of the five preceding years. The admission rate from accidental injuries was 52 per 1,000 per annum. The median rate for the 5-year period is 65.

Health conditions ashore were satisfactory for the quarter. Diseases of the respiratory type were less prevalent than has been the experience for the past five years. A total of 719 cases of these diseases were reported by the shore stations in the United States, of which 234 were notified in July, 262 in August, and 223 in September. Acute catarrhal fever constituted 62 per cent of all admissions in this class. The United States naval training station, San Diego, Calif., reported 108 cases; United States naval training station, Great Lakes, Ill., 66; United States naval training station, Hampton Roads, Va., 48; and United States naval training station, Newport, R. I., 45.

Mumps, which has been prevalent during the entire year at the United States naval training station, Hampton Roads, Va., subsided during the quarter. Only seven cases of this disease were reported in July, one in August, and none in September.

During the quarter five recruits with "Diagnosis undetermined" were transferred from the United States naval training station, Hampton Roads, Va., to the naval hospital, Norfolk, Va., where a diagnosis of cerebrospinal fever was definitely established. Three of these cases occurred in the same platoon as follows, July 8, 19, and 24. The other two were widely separated in origin, one occurring August 1 and one August 2. No further spread of this disease has been observed.

Of the five cases admitted, one was fatal. The patient, a recruit with 37 days' service, was admitted to the sick list August 2 with cerebrospinal fever and died from complicating broncho-pneumonia 15 days later.

The admission rate, all causes, for forces afloat was 419 per 1,000 per annum. The median rate for the third quarter for the preceding five years is 459. There were 637 cases of catarrhal fever notified from all ships during the quarter, but as this number was distributed among numerous ships, in no instance was there an extensive outbreak.

There were three cases of cerebrospinal fever notified, one in July from the U. S. S. *Tutuila*, on the Asiatic station, one fatal case in the same month on the U. S. S. *Relief*, and one fatal case in August at the naval hospital, Norfolk, Va., received as a stretcher case from the U. S. S. *Arkansas*.

Two cases of typhoid fever were reported, one in July from the U. S. S. *Pittsburgh* on the Asiatic station and one in August from the U. S. S. *Rochester*. One case of scarlet fever was notified in July by the U. S. S. *Northampton*.

TABLE NO. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended September 30, 1930

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	75,461	41,236	19,597	116,697
All causes:				
Number of admissions.....	7,913	5,266	2,532	13,179
Annual rate per 1,000.....	419.45	510.82	516.81	451.73
Disease only:				
Number of admissions.....	6,931	4,646	2,242	11,573
Annual rate per 1,000.....	367.40	450.29	457.62	396.69
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	1,618	1,367	625	2,985
Annual rate per 1,000.....	85.77	132.60	127.57	102.32
Venereal disease:				
Number of admissions.....	2,826	879	616	3,705
Annual rate per 1,000.....	149.80	85.27	125.73	127.00
Injuries:				
Number of admissions.....	908	618	288	1,526
Annual rate per 1,000.....	48.13	59.95	58.78	52.31
Poisoning:				
Number of admissions.....	74	6	2	80
Annual rate per 1,000.....	3.92	.58	.41	2.74

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1930

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,945	2,019	85,628	1,212	18,393	500	116,697
CAUSE: DISEASE								
Primary	Secondary or contrib- utory							
Abscess, brain.....	None.....	1		1				2
Appendicitis, acute.....	Pneumonia, broncho.....			1				1
Do.....	Hemorrhage, meso-ap- pendix.....			1				1
Do.....	Peritonitis, general acute do.....			3				3
Appendicitis, chronic.....	Obstruction, intestinal, from external causes.....			1				1
Do.....	Angina pectoris.....			1				1
Arteriosclerosis, general.....	Arterial hypertension.....			1	1			1
Do.....	Poisoning, anesthesia, ethylene.....			1				1
Cholecystitis, chronic.....	None.....			1				1
Cerebral hemorrhage.....	do.....					1		1
Cerebrospinal fever.....	Abscess, brain.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Do.....	Peritonitis, general acute			1				1
Diverticulitis, sigmoid col- on.....	None.....	1						1
Encephalitis, lethargic, acute.....	Embolism, cerebral.....			1				1
Endocarditis, acute, ulcer- ative (malignant).....	Arterial hypertension.....	1						1
Hemorrhage, cerebral.....	Edema, lungs.....	1						1
Influenza.....	None.....			1				1
Leukemia, lymphatic.....	Uremia.....			1				1
Nephritis, chronic.....	None.....			1				1
Paralysis, ascending acute.....	do.....			1				1
Pneumonia, lobar.....	Poisoning, neo-arsphen- amine, acute.....			1		1		2
Syphilis.....	None.....			1				1
Tuberculosis, chronic pul- monary.....	Tuberculosis, intestines.....					1		1
Do.....	Tuberculosis, larynx and mesenteric lymph glands.....			1				1
Do.....	Tuberculosis, mesenteric lymph glands.....	1						1
Tuberculosis, meninges.....	None.....			1				1
Tuberculosis, general mili- ary.....	do.....			1				1
Ulcer, stomach.....	Peritonitis, general acute			1				1
Total for diseases.....		5		25	1	3		34
CAUSE: INJURIES AND POISONING								
Abrasion, left great toe.....	Septicemia.....			1				1
Asphyxiation, illuminat- ing gas.....	None.....					1		1
Avulsion, left stenoclavi- cular joint.....	Rupture, subclavian vein with hemorrhage into pleura.....			1				1
Burns, multiple.....	None.....			2				2
Crush, chest.....	do.....			1				1
Drowning.....	do.....			9		1		10
Do.....	Psychosis, unclassified.....			1				1
Fracture, compound, fem- ur.....	Septicemia.....					1		1
Fracture, compound, skull.....	Hemorrhage, intracra- nial.....			1				1
Do.....	Meningitis, cerebral.....			1				1
Fracture, simple, skull.....	Alcoholism, acute.....			1				1

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1930—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,945	2,019	85,628	1,212	18,393	500	116,697
CAUSE: INJURIES AND POISONING—Continued								
Primary	Secondary or contrib- utory							
Fracture, simple, vertebra.....	None.....			2				2
Injuries, multiple, extreme.....	do.....			11		1		12
Landplane crash:								
Injuries, multiple, ex- treme.....				1	2	1		4
Do.....	Burns, multiple.....			1				1
Intracranial injury.....	Hemorrhage, intracra- nial.....			1				1
Strangulation, neck.....	None.....			3				3
Wound, gunshot, abdo- men and chest.....	Peritonitis, local, acute.....					1		1
Wound, gunshot, chest.....	None.....			1				1
Wound, gunshot, thigh.....	Hemorrhage, intracra- nial.....			1				1
Wound, penetrating, brain.....	None.....		1			3		4
Do.....	Hemorrhage, intracra- nial.....	1						1
Do.....	Psychoneurosis neuras- thenia.....	1						1
Wound, penetrating, chest.....	None.....					1		1
Wound, penetrating, heart.....	do.....			1	1	1		3
Poisoning, acute, bichloride of mercury.....	do.....			1				1
Poisoning, acute, methyl.....	Dilatation, stomach, acute.....					1		1
Poisoning, acute, carbon monoxide.....	None.....			1				1
Poisoning, acute narcotic (unknown).....	Alcoholism, acute.....			1				1
Total for injuries and poisoning.....		2	1	43	3	12		61
Grand total.....		7	1	68	4	15		95
Annual death rate per 1,000:								
All causes.....		3.13	1.59	3.18	13.20	3.26		3.26
Disease only.....		2.24		1.17	3.30	.65		1.17
Drowning.....				.47		.22		.38
Other injuries.....		.89	1.59	1.40	9.90	2.17		1.58
Poisoning.....				.14		.22		.14

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval-training stations:

Cumulative data	Number	Per cent of recruits received	Per cent of recruits reviewed
<i>Jan. 1 to Dec. 31, 1929</i>			
All naval training stations:			
Recruits received during the period.....	13, 531		
Recruits appearing before board of medical survey.....	709	5.24	
Recruits recommended for discharge from the service.....	323	2.39	45.56
<i>July, August, and September, 1930</i>			
United States Naval Training Station, Hampton Roads, Va.:			
Recruits received during the period.....	568		
Recruits appearing before board of medical survey.....	6	1.06	
Recruits recommended for discharge from the service.....	3	.53	50.00
United States Naval Training Station, Great Lakes, Ill.:			
Recruits received during the period.....	942		
Recruits appearing before board of medical survey.....	65	6.90	
Recruits recommended for discharge from the service.....	31	3.29	47.69
United States Naval Training Station, San Diego, Calif.:			
Recruits received during the period.....	1, 071		
Recruits appearing before board of medical survey.....	2	.19	
Recruits recommended for discharge from the service.....	1	.09	50.00
United States Naval Training Station, Newport, R. I.:			
Recruits received during the period.....	624		
Recruits appearing before board of medical survey.....	55	8.81	
Recruits recommended for discharge from the service.....	15	2.40	27.27

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations.

Color blindness.—Enlisted at Philadelphia, Pa., August 5, 1930. Examination at naval training station revealed definite red-green blindness. There was inability to distinguish between pronounced shades of these colors and complete failure with Stilling's test numbers. The ophthalmologist at the naval hospital verified this finding. Surveyed August 9, 1930.

Pyorrhea alveolaris.—Enlisted at Birmingham, Ala., August 12, 1930. There was marked pyorrhea and gingivitis, with Vincent's infection. Gums were spongy and retracted. The lower incisors were very markedly loosened and the alveolar process showed bone destruction. Tooth No. 18 was missing; No. 31 had a large cavity. The condition had advanced to such a stage that extensive dental work was immediately required and many extractions would undoubtedly have been required. Surveyed August 22, 1930.

Dental defects.—Enlisted at Chicago, Ill., September 5, 1930. Teeth Nos. 1, 13, 15, 17, and 32 were missing or unerupted; Nos. 2, 3, 4, 5, 6, 7, 14, 18, 19, 20, 28, 29, and 30 were carious. Exodontia was indicated in Nos. 4, 5, and 30; probable pulp involvement in others. Faulty calcification of teeth was probably due to metabolic dis-

turbance in early life. Teeth were generally unsound. Surveyed September 8, 1930.

Otitis, media, chronic.—Enlisted at Cleveland, Ohio, August 1, 1930. Physical examination upon arrival at a naval training station revealed disease of the right ear with perforation of the drum and discharge of pus. Surveyed August 7, 1930.

Organic heart disease.—Enlisted at Cincinnati, Ohio, July 23, 1930. There was a definite systolic murmur at rest, transmitted to mid-scapular line, and exaggerated after exercise. The thyroid gland was hypertrophied and there was tachycardia and marked tremors of the fingers. In addition, the recruit was twenty pounds underweight and had flat feet. Surveyed July 26, 1930.

ADMISSIONS FOR INJURIES AND POISONING, THIRD QUARTER, 1930

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the third quarter, 1930, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, July, August, and September, 1930	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1929
INJURIES			
Connected with work or drill.....	662	2,269	2,738
Occurring within command but not associated with work.....	451	1,546	1,818
Incurred on leave or liberty or while absent without leave.....	413	1,416	1,354
All injuries.....	1,526	5,231	5,910
POISONING			
Industrial poisoning.....	10	34	34
Occurring within command but not connected with work.....	67	230	157
Associated with leave, liberty, or absence without leave.....	3	10	37
Poisoning, all forms.....	80	274	228
Total injuries and poisoning.....	1,606	5,505	6,138

PERCENTAGE RELATIONSHIPS

	Occurring within command				Occurring outside command	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or A. W. O. L.	
	July, August, and September, 1930	Year 1929	July, August, and September, 1930	Year 1929	July, August, and September, 1930	Year 1929
Per cent of all injuries.....	43.4	46.3	29.5	30.8	27.1	22.9
Per cent of poisonings.....	12.5	14.9	83.8	68.7	3.7	16.4
Per cent of total admissions, injury and poisoning titles.....	41.8	45.1	32.3	32.2	25.9	22.7

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from July, August, and September, 1930, reports, are worthy of notice from the standpoint of accident prevention:

Unsafe practice—operation of laundry machinery by inexperienced man.—A seaman, second class, received a sprain of the elbow and wrist when his arm was caught in the rollers of the wringer while at work in the laundry of the training station. The case was reported as due to man's own negligence. Loss of time, 32 days.

Unsafe practice—careless operation of bread-cutting machine.—Through his own negligence, a seaman, first class, suffered a lacerated wound of the third and fourth fingers when he attempted to remove bread from a slicing machine without waiting for the knife to stop revolving. Loss of time, five days.

Unsafe practice—unguarded open hatch.—Due to the lack of safety device where such was indicated, a seaman, first class, suffered a lacerated wound of the scalp when he fell through an open hatch while going to his quarters. Loss of time, 15 days.

Flying particles—lack of eye protection.—Flying particles became imbedded in the cornea of the eye of a seaman, who was chipping paint without wearing goggles. Loss of time, five days.

Steam-line hazard.—A fireman, third class, was severely burned about the legs and feet when the supply valve of the steam line on which he was working was opened by another person. The case was reported as due to "negligence of others." Loss of time, 27 days.



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IN CHARGE



Edited by
LIEUTENANT COMMANDER ROBERT P. PARSONS
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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to the exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes, and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,
Surgeon General United States Navy.

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NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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U. S. NAVAL MEDICAL BULLETIN

VOL. XXIX

JULY, 1931

No. 3

SPECIAL ARTICLES

MEDICAL ASPECTS OF SUBMARINE "LUNG" TRAINING

By L. K. MACCLATCHIE, Lieutenant (Junior Grade), Medical Corps, United States Navy

The following report is based on five months' observation as medical officer and instructor at the training tank at New London, Conn., where submarine personnel is instructed in the use of the "lung" as a means of submarine escape.

The training tank is a structure about 130 feet in height and 18 feet in diameter. It is filled with heated salt water. Escape locks are located at points 18 and 50 feet from the top. A cylinder at the bottom of the tank represents a submarine compartment with standard door for entering and a standard hatch for escaping. At the top a diving bell is suspended by a wire cable. The bell is operated by an electric motor so that it can be raised or lowered in the water. Its capacity is three men. Normally two men and an instructor go down in the bell to the desired depth when the men are sent out to practice the escape.

In the course of training the first 300 men there occurred three cases of collapse which, at first, seemed to have a rather obscure etiology. Further work and investigation of this subject has, I believe, cleared up the etiology and suggested treatment.

While these cases represent less than 1 per cent of the men trained, it is felt that they are very much worth while reporting, since extensive training in the use of the "lung" is being carried on and will be carried on. This training and the apparatus are comparatively new in the service, and problems now arising will probably not be present when the training is more universal and the submarine service as well as the general service is better acquainted with this work.

At this point it might be well to give an outline of the training as carried out in New London in order that what follows may be better understood.

The student first goes into the decompression chamber and is subjected to a pressure of 50 pounds. Men with sinus trouble, chronic ear disease, or nonpatent eustachian tubes are usually eliminated at this stage, having to come out before the first atmosphere, or about 14 pounds, is reached. Should the man not be able to stand the pressure he is eliminated at this stage.

After passing this test the student is taken to the top of the tank and learns to use the lung by practicing on the ladders, which extend about 15 feet into the water from the top of the tank. When he has done this to the satisfaction of the instructors, he is taken down to a depth of 10 feet in a diving bell and escapes up a line to the surface. (This depth was added after the three accidents as an additional step in instruction.)

After completing this, he is taken down in the bell to a depth of 18 to 20 feet or into the 18-foot lock, and escapes up a line to the surface, making one stop on the way up. After making two such escapes successfully, he is adjudged ready for the next depth, which is 50 feet.

Two 50-foot escapes are next made, either from the diving bell or the 50-foot lock. In coming up from this depth he makes three stops—the first at 30 feet, where he counts 10 breaths; at 20 feet, for 20 breaths; at 10 feet, for 30 breaths; and then to the surface. This amount of decompression is not necessary at this depth, but it is given as a practice for the next step, which is 100 feet. When ready for the 100-foot escape, the man goes into the 100-foot compartment and escapes up a line to the surface, making the same stops as in coming up from 50 feet.

At the present time a man is only required to make two 18-foot escapes, but, after going this far, most men wish to continue and take the whole course.

In the cases at New London the symptoms and physical findings were almost exactly similar. The etiology, as far as can be determined, appeared to be identical in each case.

The cases, which will later be described in more detail, occurred when the men either let go of the line and shot to the surface or came up very rapidly, holding their breath while doing so. In each case the men reached the surface in an apparently normal state and then, after varying lengths of time, slowly collapsed into a state of either unconsciousness or semiconsciousness. While in this state they evidenced the symptoms of shock, except for extreme muscle rigidity. In each case there was a slowing of the heart, absence of radial pulse, rigidity and extreme coldness of the body and extremities, dilatation of the pupils, and rapid shallow respirations. The skin was cold and somewhat cyanotic. The length of duration of this state varied from

about 15 minutes to 30 minutes. Two cases showed unconsciousness and one man was semiconscious throughout. There were various manifestations during this time, called hysterical for want of a better term, present in all cases.

In order to make some comparison, a set of questions was made up and each man's replies obtained. The questions, while leading, were put in such a way as to eliminate as far as possible any suggestions on the part of the examiner. Although the incidence is less than 1 per cent, such accidents must be recognized as a possibility in future training and perhaps in emergency escapes.

Case 1.—Sea 2c., U. S. Navy, U. S. S. O-8.

Made two successful 18-foot escapes. Seemed to take training very well. He started up the line from the 50-foot lock, apparently breathing normally. When just above the first stop (30 feet) he let go of the line and shot to the surface. Upon reaching the surface he said in a cheerful mood to the instructor, "I passed four men on the way." Just after removing the lung he collapsed.

He was carried into the decompression chamber. Upon examination the radial pulse was found to be absent, the heart rate somewhat slow, the body and extremities cold, and all the muscles rigid. The pupils were dilated, but reacted to light. Respirations were shallow and rather rapid (20-30 per minute). He did not answer questions and frequently made convulsive though apparently voluntary movements.

At the pressure of 10 pounds he revived and the body warmed up. At 15 pounds he appeared completely normal; stimulants were administered and the pressure reduced to 5 pounds for three minutes, after which it was entirely released.

After a short while the patient put on his clothes and, except for some weakness and stiffness, he felt perfectly normal. After about an hour's observation, he was allowed to go to lunch and was kept under observation for the rest of the day.

His statement is as follows:

I was in the 50-foot lock and Lieutenant — was going to send me up the line. I put on the lung and he put the noseclip on and I tested the lung. Then I went out into the tank and up the line. When I reached the first stop another man was there. I took 10 breaths at the first stop. About 5 feet above the first stop it became very hard to breathe. The man above was going too slow for me and a man below me was crowding me. When I couldn't get any more breaths I let go of the line and passed the man ahead. When I reached the surface the man at the top asked me what was wrong. I told him I passed a couple of men down below. I was feeling all right at this time. When I climbed out of the tank I took my lung off. Then I got a pain in my stomach and my legs got weak and I fell to the deck. The chief petty officer told me to try and stand, and I arose almost to my knees and then fell back again. Then my eyes closed and I couldn't open them.

Then the men carried me out. I remember the cold air hitting me as they started down the ladder and that's the last I remember until I came to in the decompression chamber.

Case 2.—S. C. 1c., U. S. Navy, U. S. S. O-6.

Nonswimmer. Learned to use the lung with some difficulty, but was finally adjudged ready for the 18-foot escape. On coming out of the bell he slid up about 8 feet to the marker on the line, stayed there for three or four breaths, and then shot to the surface, holding onto the line as he came. He climbed out of the tank, removed the lung, and walked over to the window, then slowly collapsed and lapsed into a semiconscious state.

When examined there was coldness of the body and extremities, rigidity of the muscles, and absence of radial pulse. The respirations were shallow and rapid.

After about 15 minutes, he revived and apparently suffered no ill effects. When seen about two hours later, he stated that he believed that fright accounted for his trouble. His statement follows:

Two of us went down in the bell and I watched the man with me go out to learn something about escaping. Then I put my own lung on and took a couple of breaths before leaving the bell and then ducked out and put one leg around the line. Then I slid up to the ball on the line and stopped. After three or four breaths the air seemed to get under my dental plate and I lost the lung from my mouth. I let go of the line and then grabbed it again and tried to put the lung back in my mouth. When I couldn't do this, I shot to the surface, holding the line with my hand. Then I crawled out of the tank and walked a couple of steps and my knees gave away and I fell on to the deck. After awhile I felt all right. I don't remember my legs being stiff. I couldn't seem to straighten them out and they seemed to want to double up [legs were straight].

Case 3.—Matt. 2c, U. S. Navy, U. S. S. S-4.

This man has been attached to the S-4 for about two years and during that time has seen the lung used innumerable times and has seen the rest of the crew use it and become extremely proficient in its use. During the summer of 1929, when instruction was being carried on in the Y. M. C. A. pool at New London he became quite proficient in its use at the limited depths present there. He made two 18-foot escapes, in the first of which he let go of the line after stopping at the first stop and shot to the surface. After being cautioned to come up slowly, he made a successful 18-foot escape. In his first 50-foot escape I myself was the instructor. He seemed to be quite nervous as time came for the escape and was given full instructions and his equipment was carefully looked over and seen to be working properly before he was allowed to leave the bell. He made all of his stops on this escape, but it was apparent to watchers on the surface that he did not pause for the full 30 breaths at 10 feet.

After a short pause at this depth he shot to the surface. He was warned of the fact that he might get into difficulties if he did not come up slowly and was also told to keep on the line at all times.

After a period of an hour or so the man again went down in the bell and this time let go at about 40 feet and shot to the surface. Upon reaching the surface he appeared normal for a period of 30 seconds or so and held on to the ladders. He did not answer questions, however.

About a minute later he slowly collapsed in the water and was pulled out and placed in a recumbent position. The extremities and body were cold and the muscles were rigid. Breathing was shallow and rapid and the pupils were dilated, but reacted to light. The radial pulse was absent and the heart seemed slow and weakened.

After about 15 minutes the patient began to make groaning sounds and to roll his eyes about. He would not answer questions. He was allowed to rest for about 15 minutes more. At the end of this time he was asked a number of questions, but to all of them he gave rather vague and meaningless answers. He was then dressed, but gave no assistance to this act and made thrashing, and apparently hysterical, movements with arms and legs. When assisted to sit up he fell back and made no effort to assist those helping him. The man seemed to be in an hysterical state. When seen about a half hour later he complained of loss of vision, even to light, and anæsthesia of left foot and leg. After about two hours, believing this condition to be a traumatic neurosis, the man was carried to the decompression chamber and the pressure raised to 25 pounds. During the time the pressure was being applied he seemed to pay little heed to instructions and did not do exactly as he was told, and constantly complained about not being able to see.

He was told that he was in the chamber in order to help his vision, but this apparently made no impression on him. At times he seemed to be watching the man handling the air valve, and would immediately get a pain in his ears before the pressure had increased enough to warrant this.

The pressure was gradually raised to 25 pounds and remained at this level for 10 minutes. It was then decreased to 15 pounds for 5 minutes, then to 10 pounds for 7 minutes, and then to 5 pounds for 10 minutes, after which it was released. During the time in the chamber the man's mental or physical state did not improve or change in any way apparent to the medical examiner. He seemed to be in a more or less hysterical state and occasionally thrashed about wildly for no apparent reason. After coming out of the chamber the man was taken to the dispensary, being carried there on a stretcher. He made no effort to help himself in any way.

His objective symptoms at this time were numbness and anesthesia of the left leg and loss of vision. The man's complaint of blindness varied; at times he claimed he could tell light and dark; at other times could not. Physical examination was entirely negative and all neurological examinations were negative. Examination for superficial and deep reflexes, pain, touch, and temperature gave normal responses. Ophthalmoscopic examination was negative.

Five hours later the man complained of the same symptoms. At this time one of the crew went to see him. The patient was asked if he wanted a cigarette and answered in the affirmative. He claimed not to be able to see the cigarette, but reached for a box of matches and lit the cigarette in a normal manner. When some person would enter the room the man would turn and appear to be watching him at times.

When seen at 9 o'clock (p. m.) he still presented the same symptoms, and was told that his vision would be normal in the morning.

The next morning the man appeared to be perfectly normal. He still complained of anesthesia of the left leg and walked in a manner to favor this leg (when observed). At other times he walked normally. After a few days this symptom cleared up also. His statement follows:

When I left the bell I was all right and then I stopped at the bobbin just outside the bell (about 8 feet from bell) and then the lung was very hard to breathe into. Some one had told me to push the lung a little when it got that way and so I pushed it and all the air rushed into my throat and I think into my lungs. Then I took the mouth piece off and let go the line and came to the surface. I remember shooting up very fast. I held my breath on the way up. When I got to the top, I went over to the ladders and the people asked me what was the matter. My chest hurt and I got weak and couldn't answer the questions. I remember being taken out of the water and that's all. I remember people talking to me later and I couldn't see. I remember being carried down the ladder and going into the decompression chamber and then to the sick bay.

Several of the instructors have experienced a feeling of slight dizziness during escapes with the lung, especially during the long rise to the first stop. The sensation is relieved upon stopping and taking a few breaths on the line. This dizziness is believed to be caused by a slight increase in intrathoracic pressure, due to drop in water pressure and the resulting expansion within the lungs and the apparatus. Further uneasiness has been experienced by the increased resistance to expiration. It seems natural for a person to reduce his expiration when he is exhaling against the pressure in the "lung" bag. This results in reduced inspiration. As this reduction progresses, a sensation of suffocation occurs, and unless the subject has been cautioned about this and has been taught to correct it the effect of the sensation of suffocation combined with the sense of dizziness

may produce panic or hysteria, thus causing the man to rush to the surface. In almost all cases once the man makes the initial escape and learns to breathe under water, he has no difficulty in completing the training.

In the cases cited the men tried to follow instructions, but were unable to do so for some reason. All agreed that they were frightened when breathing became difficult. Had they made strenuous efforts to follow instructions and overcome the pressure in the bag it is probable that no such accidents would have occurred.

The last case is described more in detail because the symptoms appeared to be much more severe. Many of these symptoms, however, seem to be quite clearly mental. The other cases showed transitory, if any, symptoms after recovery of consciousness. In these cases the psychic factor can probably be largely ruled out.

As to the etiology, this seems best explained on the basis of the experiments of Valsalva. Valsalva in 1700 found that he could produce dizziness or even loss of consciousness by pressure, made with the abdominal muscles at the height of deep inspiration, with the respiratory passages closed. During defecation these conditions may be closely approximated in our everyday life. General expiratory effort with the air passages closed, at the height of inspiration, increases the symptoms. Many persons are familiar with this experiment performed in the following way: The subject takes a deep inspiration and closes his respiratory passages. Sudden pressure is made on the chest wall by another person (best performed by the second person standing behind with the arms locked about the chest of the subject), with the result that the subject loses consciousness.

The effect in such cases is to raise the pressure in the bronchi and alveoli. This increased alveolar pressure sends the blood forcibly from the left heart into the general circulation. There can not be a corresponding increased flow of blood to the right heart because the increased intrathoracic pressure has restricted the lumen of the venous trunks. The pressure is also exerted on the heart wall so that there results a withdrawal of the heart content of blood.

The greatest expiratory pressure increase with the glottis open is brought about by blowing against resistance. This increase may reach about 250 millimeters of mercury ($\frac{1}{3}$ atmosphere). If pressures of up to 250 millimeters can be reached with the glottis open, certainly much higher pressures may be obtained with the glottis closed.

The manifold changes brought about by the Valsalva experiment were studied by Mosler and Balsamoff (1) on a group of athletic volunteers and they record the following results:

(1) During the Valsalva experiment, there is actual decrease in the size of the heart as shown by X ray. The X ray shows a decrease of $\frac{1}{2}$ to 3 centimeters in the transverse diameter. The shadows of the vessels were lessened by but a few millimeters. The systolic contractions were at first very forceful, but later became weaker and more frequent, and, later, seemed to disappear. At the end of the experiment the heart, which had been practically emptied of blood, resumed the forceful contractions.

(2) During the Valsalva experiment the diaphragm is not still, but rises and falls slightly ($\frac{1}{2}$ to 1 centimeter). This is considered by Von Bruck a "reenforcement of the circulation through the diaphragm," but probably is due to an attempt at equalization of the pressure in the abdominal and thoracic cavities.

(3) The radial pulse disappeared early in the experiment. This was not due to collapse of the subclavian, as Pongs thought, for they found that the carotid and temporal pulses also disappeared. It must therefore be explained by the emptying of the heart.

(4) The blood pressure mounted quickly (50 to 70 millimeters) after the beginning of the experiment. This was maintained for a few beats (4 to 7), and then there was sudden fall in pressure (40 millimeters), which continued from 1 to 3 beats, and then the pressure fell to zero.

(5) Capillary pulse was observed in subjects without heart lesions after the resumption of breathing following the experiments.

(6) There is also dizziness and numbness caused by congestion in the head due to decreased venous return.

From the work above the symptoms and findings noted in the three cases described can be explained. The men in all cases shot to the surface, holding their breath while doing so. Due to the expansion of air in the lungs the conditions of the Valsalva experiment were satisfied. In the extreme case of the man coming up from about 40 feet, the possible sudden increase in intrathoracic pressure was about $1\frac{1}{2}$ atmospheres, or about 16.9 pounds per square inch. The possible increase in the case of the man coming up from 10 feet was about one-third atmosphere, or about 4.17 pounds. These increases are entirely sufficient to produce the symptoms noted in the respective cases. It is worthy of note that the severity of symptoms seemed to vary with the possible increase in intrathoracic pressure.

Undoubtedly in case 3 the psychic factor was very prominent. The etiological factors were sufficient, however, to produce a rather marked traumatic neurosis.

This leads to the question of treatment, and in this connection I believe that the use of recompression is not indicated. Mosler and Balsamoff warn that in case of diseased hearts the Valsalva

experiment may prove of the greatest harm and fatalities may result. The ill-advised use of high pressures in treating all accidents occurring during underwater work is a dangerous and useless procedure. Pressure treatment is aimed at one condition, caisson disease, and unless the symptoms are directly attributable to compressed-air disease it may do more harm than good. In the above cases pressure was used in two instances, in one case because the decompression chamber was the only place in which we could get the man warm, and in the other case after a lapse of two hours in an effort to overcome the psychic factor. In no case was the pressure raised above that which the man had been under during the test. With such short exposures and at depths of not over 50 feet the question of "bends" can be definitely ruled out.

The treatment can be discussed under two headings, prophylactic and symptomatic. Since the last case occurred, more than 200 men have been trained at this station, most of them completing the 100-foot escape without a single accident. At the present time the possibility of such accidents is recognized, and the men are carefully watched and are repeatedly cautioned to stay on the line and come up slowly in case of difficulty. The question of air expansion is explained and the procedure necessary to overcome the increased internal pressure in the lung is emphasized. The men are told and shown that if they stay on the line and come up slowly, exhaling as they come, that it is possible to escape from 50 feet without the lung. The necessity of exhausting the expanding air in the lungs is also emphasized. Another step in training, an escape from 10 feet, has been added to the course in order that the students may gain more confidence. Full explanations and the avoidance of rushing the student are emphasized in order that he may fully understand the work and the technique of the use of the appliance.

Symptomatic treatment includes general supportive treatment such as rest and warmth. Cardiac and respiratory stimulants may be administered if desired. Whisky or a substitute might be very valuable.

CONCLUSIONS

1. During the lung training, unless care is exercised in the matter of training and gaining the confidence of the students, cases of collapse may occur.
2. These cases may be fatal in case of weak hearts.
3. Treatment by recompression is not indicated and may be dangerous.

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BIBLIOGRAPHY

- (1) Mosler and Balsamoff: Über den Valsalva-Versuch: Ein Kritisches Referat. (The Valsalva Experiment, a critical report.) Klinische Wochenschrift, Sofia, 1924, XII, 291.
- (2) Textbook of Human Physiology, Landois and Sterling (Fourth Edition), 1891, p. 103.
- (3) Mankin, G. H. Individual Submarine Escape, U. S. Naval Medical Bulletin, Vol. XXVIII, No. 1, January, 1930, p. 18.

EDITOR'S NOTE

For many years the bureau has been intensely interested in the medical aspects of life on board submarines and in the physiological problems involved in diving. The introduction of the escape apparatus has added many new problems of extreme importance and interest.

A serious loss was felt in this work following the resignation, two years ago, of Dr. G. H. Mankin, who had long been intimately associated with these problems. Several medical officers are now wholly employed in research problems related to submarine and diving service and "lung" escape training, and one is now engaged in postgraduate study of these problems at a leading university.

The following article, by Dr. E. W. Brown, represents the most recent information on the physiological aspects of submarine escape work, collected by carefully planned effort with direct observation and by consultation with leading American and British authorities.

The third article, by Dr. B. H. Adams, is somewhat in conflict with the ideas expressed in the first two articles. Much speculation and some controversy will naturally arise over the questions of etiology and treatment of accidents incident to "lung" training, since many phases of the subject are still far from being settled with any degree of finality. It appears that certain factors, still unsuspected and of which we still have meager knowledge, may play prominent parts of responsibility in these accidents.

The bureau will welcome any reports of observations by medical officers serving with submarine units, and the BULLETIN will be glad to use material suitable for publication in order to add to an already rather extensive and quite valuable literature on these subjects.

SHOCK DUE TO EXCESSIVE DISTENSION OF THE LUNGS DURING TRAINING WITH ESCAPE APPARATUS

By E. W. BROWN, Captain, Medical Corps, United States Navy

The three cases of shock presented in Doctor MacClatchie's paper in this issue of the BULLETIN were undoubtedly mainly due to overdistension of the lungs. The writer has obtained access to the records of three additional cases in connection with lung training at the experimental diving unit, navy yard, Washington, D. C. They will be designated as cases 4, 5, and 6.

CASE 4 (H. H.): Descended in the diving bell of the mine tank to 30 feet. At this point, due to a leaky connection, the bell began to fill with water. The subject rapidly inserted the mouthpiece of the

"lung," applied the nosepiece, and ducked out, but forgot to open the valve to the breathing bag. He ascended quickly, holding his breath, and removed the "lung" on reaching the surface. In a few moments he felt dizzy and weak and collapsed, lapsing into unconsciousness. The body and extremities were cold, skin pale, lips and ears cyanotic, pulse faint, and respirations shallow. Not reacting to artificial respiration and massage of extremities, he was carried to the recompression chamber. He partially recovered consciousness on the way, but was unable to move his extremities. There was a sensation of numbness, with prickling of the hands, legs, and feet. He was recompressed to 40 pounds and decompressed over a period of 35 minutes, during which time he reacted. The numbness and prickling cleared up in two hours, but headache persisted for 24 hours. There were no other sequellæ.

CASE 5 (J. L.): Lowered in the diving bell to 60 feet and adjusted the "lung." On ascending gradually he let go of the line at about the 10-foot stop and shot to the surface. It does not, however, seem plausible that the symptoms ensuing could have resulted from so short an ascent as 10 feet. On removing his "lung" he collapsed, becoming semiconscious with dyspnea and inability to move his extremities. He was recompressed to 30 pounds and decompressed in 49 minutes, with rapid improvement. General weakness again set in with severe headache in about 45 minutes. During a second recompression he obtained permanent relief.

CASE 6 (I. S. K.): Lowered in a diving bell to 35 feet, planning to inflate the "lung" with his exhaled air and ascend, rebreathing from the bag. He was unable to inflate the appliance because of a defective mouthpiece. He, therefore, ducked out and quickly ascended, paddling to accelerate his speed, and holding his breath. He was unable to breathe on reaching the surface and collapsed in a few moments, becoming semiconscious with sensations of numbness, aching, and prickling of the extremities; body and extremities cold; feeling of pressure in the head. He was recompressed to 45 pounds, with decompression over a period of two hours, and reacted. In the course of an hour there was a recurrence of headache, numbness, and weakness. Recompression was again effected, during which period he reacted without subsequent symptoms.

Experiments have been carried out with dogs, reproducing, at least to some extent, the condition of lung distension induced in the above cases. Chillingworth and Hopkins (1) (2) enclosed a dog hermetically in a box with a tube to the outside from the trachea and distended the lung by reducing the pressure of the container. The systemic systolic blood pressure progressively fell with increase of lung distension until zero was reached. The fall in blood pressure

was due to failure of the blood supply to the left heart, caused in turn by compression of the pulmonary capillaries. The authors point out that the pulmonary capillaries lying between adjacent alveoli are compressed between opposing forces when the intrapulmonic pressure is sufficiently increased. The final total failure of systemic circulation was due to the fact that the maximal pressure in the pulmonary artery was not sufficient to withstand an external air pressure of more than 85 mm. of mercury.

Taking the pulmonary arterial pressure as an index of safety during distension of the lungs, the above workers found that with 50 mm. increase in the intrapulmonic pressure the carotid and pulmonary arterial pressures became equal. The limit of safety, therefore, in dogs lies below this degree of pressure, and death has resulted from air pressures of 30 mm. and even less. There is no reason to believe that the pulmonary capillaries of man are more resistant to occlusion than are those of the dog or that there exists much difference in their relative blood pressures.

Dawson and Hodges (3) in 1920 studied the Valsalva experiment in men. During the height of such an experiment the radial pulse became imperceptible and the heart sounds on auscultation were indistinct or even inaudible. The systolic blood pressure fell to a point below 60 mm.

The actual intrapulmonary pressure set up by sudden ascent from any definite depth may be theoretically calculated. This includes the assumption that the lungs will expand under pressure to a volume equivalent to that of the complementary air, or approximately 100 cubic inches, before compression is actually exerted on the intrathoracic structures. The computation is based on the familiar principle of the inverse ratio of volume to pressure, the volume of the lungs being taken as 230 cubic inches at ordinary pressure, but expanding to 330 cubic inches before compression effects may be induced. The net maximum intrapulmonic pressures attained on ascending with breath retention from 66, 40, 33, 30, and 20 feet, respectively, would approximate 824, 410, 304, 253, and 91 mm. of mercury. The average maximum pressure which can be exerted by the expiratory muscles by blowing against a mercury column is about 185 mm. The great danger of ascent under these conditions from any depth in excess of 20 feet is obvious. These data, of course, to be accepted, would require actual experimental work.

It should be borne in mind that asphyxia may be a complicating factor in the cases of collapse under discussion. It is recognized that the breath can be held by some individuals for 60 seconds, but this is usually preceded by deep inhalation. It is true that in the cases under consideration that the breath is probably not held

for longer than 10 seconds. Due to apprehension and excitement, the subject may have unconsciously suspended his breathing for several seconds before donning the "lung." He may even have forcibly expired before so doing. It has been observed in training with mine rescue breathing apparatus that asphyxia may occur with some individuals in a surprisingly short time.

Treatment of cases of shock from excessive lung distension: Men should be cautioned not to hold the breath under conditions of accidentally rapid ascent, but should allow expiration to occur under water. They should also be instructed, if an ascent must be made without the lung, to exhale completely in advance, thus going up with a reduced lung volume, with reduced resultant expansion. Recompression should not be given, as the mechanism of the condition has no relation to caisson disease. Facilities for immediate application of local heat should be available.

Artificial respiration is indicated if the breathing is very shallow, but caution must be exercised in the technique. The necessity for a balance in favor of the diastolic systemic pressure over the diastolic right ventricular pressure has a bearing here. Loss of this balance by overdistension of the lungs may defeat the purpose for which artificial respiration is given by causing asphyxiation of the heart muscle even while the lungs are being overventilated. In giving artificial respiration, therefore, the inflation period should be lessened to allow the blood pressure to return to normal. It is desirable to administer oxygen with 5 per cent CO₂, the latter acting as a natural stimulus as in other types of respiratory failure. The administration of adrenaline even intravenously should be considered in serious types of these cases.

It is believed that a correction should be made relative to an article in the BULLETIN of October, 1930, entitled "A Fatal Case of Caisson Disease Following a Dive of Short Duration to a Depth of 30 Feet." The subject, who was making an escape in training with the submarine "lung," was exposed for a little less than 6½ minutes to pressure at a depth of approximately 25 feet. A few minutes after reaching the surface he collapsed and lost consciousness. He was then recompressed to 20 pounds gauge pressure (equivalent to a depth of 46 feet) and was kept at this level for 10 minutes. He was at this pressure when death apparently occurred. Artificial respiration was given with oxygen administration and continued over an hour without effect. The artificial respiration might have washed the nitrogen out of the lungs, but it could have no effect on the nitrogen in the blood or tissues because the circulation had ceased.

Let us assume that the normal man who acted as an attendant to the deceased in the recompression chamber had expired at the same time as the deceased. His 10 minutes' exposure to a pressure corre-

sponding to 46 feet would have forced into his tissues a quantity of gas practically as great as that present in the body of the deceased who had used the submarine "lung." If the two men had succumbed under the pressure in the chamber, there would have been no way for the nitrogen to escape from their bodies by reduction of the pressure, as the circulation had stopped. The appearance of the two bodies at autopsy would be essentially as described in the report. The exposure for 10 minutes at 46 feet would account for the bulk of the air bubbles observed. There is no reason why it should be ascribed to the exposure of 6½ minutes at 25 feet. In other words, the second period of compression made the autopsy worthless from the standpoint of proving the presence or absence of caisson disease.

It is the consensus of opinion among physiologists, physicians, and engineers that exposure to one atmosphere gauge, or 33 feet of sea water, does not involve any danger of caisson disease, even with unlimited exposure. This is based on the accumulated experience of many years both in sea diving and tunnel and caisson practice in engineering operations. In fact, the standard diving tables of the Navy do not prescribe decompression even for 42 feet if the exposure does not exceed three hours.

The above fatality can not, therefore, be ascribed to caisson disease. The question as to whether it was due to shock incident to overdistension of the lungs as a result of too rapid ascent appears to be ruled out. There was no evidence of failure of the "lung" to function, or any other indication of holding of the breath. A persistent thymus (found at autopsy in this case) is frequently associated with unexplained death in young and apparently normal persons.

BIBLIOGRAPHY

- (1) Hopkins, R., and Chillingworth, F. P.: Physiological Changes Produced by Variations in Lung Distension. Efficiency of the Pulmonary Circulation in Overcoming the Obstruction. *Am. Jour. Physiol.* 51:289, March, 1920.
- (2) Hopkins, R., and Chillingworth, F. P.: Impairment of the Coronary Circulation of the Right Ventricle. *Am. Jour. Physiol.* 53:283, September, 1920.
- (3) Dawson, P. M., and Hodges, P. C.: The Cardiovascular Reaction in the Valsalva Experiment. *Am. Jour. Physiol.* 50:481, January, 1920.

OBSERVATIONS ON SUBMARINE "LUNG" TRAINING

By B. H. ADAMS, Lieutenant, Medical Corps, United States Navy

In the "lung" training at Pearl Harbor, escapes are made from a bell which descends from a dock. Escapes are made first at 5 feet; then at 10, 20, and 30 feet.

Alarming symptoms were observed in three cases. In each of these instances the ascent was very rapid, resulting either from losing hold of the line or from making a deliberate rapid ascent when difficulty was experienced in exhaling into the bag. In each instance the escape was from a depth less than 30 feet. In at least one observed case a similar rapid ascent was made with no symptoms, the subject immediately descending for another escape.

Knowing the danger of rapid ascents, the instructors should use every measure to protect the student diver. The student should be thoroughly drilled in the use of the "lung" before making his first escape and should be under control at all times during his ascent, so that if he has difficulty in breathing into the "lung" he can duck back into the chamber instead of letting go of the line and shooting to the surface.

Much of the difficulty arises from the great buoyancy of the inflated bag. This causes a man, when he has lost hold of the line, to rise so rapidly as to emerge above the surface to a point below the nipple line. It has been suggested that part of the buoyancy might be overcome by using additional weight, but this is objected to by submarine men because it would add to the already too great intricacy of the apparatus.

On reaching the surface after a rapid ascent, the men appear at first quite normal and can carry on a conversation. The first symptoms appear rapidly from one to several minutes after the surface is reached. The usual symptoms are abdominal cramps, dyspnea, muscle cramps, headache, ocular pain, collapse, and unconsciousness. The nature of these symptoms and the time of their appearance are, of course, suggestive of bends, quite aside from what theoretical consideration might lead us to conclude. Also, theory aside, there is no question in my mind but that they are definitely helped by recompression.

The patients that we treated by such means as stimulants, oxygen inhalation, etc., did not clear up rapidly, but seemed to have some symptoms during that day. One patient at the submarine base, after receiving this type of treatment with only partial clearing up of symptoms, as difficulty in breathing and cramps in abdomen, was recompressed in the conning tower of an R-type submarine. The pressure was raised to 40 pounds. All symptoms cleared up at this pressure and the man was decompressed in the usual way.

It is very important in cases of deep dives for long periods that no temporizing be allowed in hustling patients into the tank and subjecting them to pressure. Procedures as manipulation of the extremities to relieve cramps, artificial respiration, administration of stimulants, and oxygen inhalation should not be given outside the tank, but can be used in the tank.

One of the most important things for the medical officer to remember in treating real caisson disease in the recompression chamber is that all symptoms may be much aggravated during the first part of the recompression period. This is what makes the medical officer hesitate to take the man to higher pressures. The cause of this increase in symptoms may be due to the discomfort of recompression and to the movement of the bubbles as their size decreases under pressure and they move along to new regions in the circulation. The medical officer should not cease the recompression but should build up the pressure quickly until symptoms are relieved or improved. High pressures can do no harm in comparison to what the bubbles can do, and this pressure reduces the bubbles to small size so absorption is hastened. As soon as the symptoms are relieved, the pressure is dropped according to directions in the Diving Manual. One deep-sea diver suffering from bends experienced an aggravation of all symptoms while undergoing recompression. The Hospital Corps man was massaging the "cramped" arm while the pressure was being built up. At about 40 pounds the patient had a severe contraction of the muscles of the right arm, throwing the corps man over his shoulder. The pressure was continued on up to 60 pounds, when the man sat up and all symptoms were relieved. He was decompressed in the usual way.

A tank for the treatment of caisson disease that will not provide a rapid recompression to high pressures is very unreliable. In severe cases the only hope is an exceedingly rapid recompression without a moment's delay. If one will read the case histories of caisson disease that have occurred in the Navy and in commercial life, he will note that many of the cases with residual disabilities were not properly recompressed at high pressures. One can not always treat bends with the same pressure under which the man was working. One can not tell the size of the bubble or where it will form by the pressure under which the man was working. We must control the bubbles in the only known way by sufficient pressure to diminish their size.

Deep diving and "lung" escape training have opened a most interesting research field to Navy medical officers. As an aid in this work it is recommended that cases of bends, caisson disease, and other disabilities resulting from this training be carefully studied and a report be required by the Bureau of Medicine and Surgery. Pertinent facts should be given so that the reports can be used as the basis for conclusions that will help clarify certain points on diving and suggest the best course to follow in treatment and in prevention.

TREATMENT OF RECURRENT HERNIA¹

By F. R. HOOK, Lieutenant Commander, Medical Corps, United States Navy

It is with considerable hesitation that I venture on a subject so shopworn as hernia. However, any condition that affects such a large number of individuals and so frequently resists the most skillful treatment can not be considered as a problem solved, and is one that must always be kept before us.

As a basis for discussion to-night I shall review the abdominal herniæ treated in the Brooklyn Naval Hospital between the dates of June 1, 1928, and December 31, 1930. This study must necessarily be incomplete, as sufficient time has not elapsed since operation in many of the cases to make a follow-up study of any value. It should be kept in mind that in this hospital we treat only male adults, so that the percentages of the various types of herniæ are apt to be somewhat different from those found in your civilian hospitals, where both sexes and all ages are treated.

The following tables show the various classes and types of hernia and their numerical distribution in the group of 801 upon which this study is based:

TABLE I

Number of herniæ.....	801
Number of patients.....	603
Classification of cases:	
Primary inguinal.....	639
Recurrent inguinal.....	76
Ventral (postoperative).....	51
Epigastric.....	19
Femoral.....	10
Umbilical.....	5
Paraduodenal.....	1

TABLE 2.—Location and types of sacs in inguinal herniæ

	Right	Left	Bilateral	Indirect	Direct	Saddlebag
Primary.....	186	133	160	300	191	88
Per cent.....	39	28	33	56	30	14
Recurrent.....	25	23	14	12	58	6
Per cent.....	40	37	23	16	76	8

TABLE 3

Types of sacs in bilateral primary herniæ:

Bilateral indirect.....	58
Bilateral direct.....	51
Bilateral saddlebag.....	13
Direct right and indirect left.....	9
Indirect right and direct left.....	8
Saddlebag right and direct left.....	6
Saddlebag right and indirect left.....	5
Direct right and saddlebag left.....	8
Indirect right and saddlebag left.....	2

¹ Read before the Brooklyn Surgical Society, February 5, 1931.

Mixed primary and recurrent herniæ (7 patients) :

Primary left and recurrent right, both direct.....	4
Primary right and recurrent left, both saddlebag.....	1
Primary right and recurrent left, both direct.....	1
Primary saddlebag left and recurrent direct right.....	1

Herniæ classified as sliding :

Sigmoid.....	10
Cæcum.....	4
Sigmoid and cæcum.....	1
Bladder.....	2

TABLE 4

Number of femoral herniæ.....	10
Number of patients (9) :	
Right side.....	5
Left side.....	3
Bilateral.....	1
Number of epigastric herniæ (19) :	
Primary.....	17
Recurrent.....	2
Mixed multiple herniæ (11 patients) :	
Bilateral inguinal and ventral.....	2
Right inguinal and ventral.....	1
Left inguinal and ventral.....	2
Bilateral inguinal and epigastric.....	2
Right inguinal and epigastric.....	2
Bilateral inguinal and bilateral femoral.....	1
Right inguinal and right femoral.....	1

We are primarily interested to-night in the recurrent type of inguinal hernia and the postoperative ventral hernia. The following sequence will be followed in discussing the former :

1. What is a normal recurrence rate in inguinal hernia?
2. What is the cause of recurrence?
3. What methods of repair are apt to give the lowest percentage of recurrences and cure the highest percentage of those that have recurred?

RECURRENCE RATE

Coley (1) (2) in 1918 reported 5.7 per cent recurrences, and in 1924, 8.7 per cent. Taylor (3) in 1920 reported 5.6 per cent recurrences in indirect, and 19.08 per cent in direct herniæ at the Johns Hopkins Hospital. Erdman (4) reported 7.5 per cent recurrences. Lyle (5) reported a recurrence rate of 10.30 per cent with catgut sutures as against 5 per cent with fascial sutures. Oudard and Jean (6) reported 10 per cent recurrences in the French Navy. Darling (7) gives the recurrence rate in indirect as 3 to 10 per cent and in direct as 10 to 26 per cent. McEachern (8) states that recurrence following operations for direct hernia in those over 50 years of age is so frequent that many surgeons refuse to operate.

Of the 715 inguinal herniæ treated in this series, 76 of them were recurrent, making an admission recurrence rate of 10.6 per cent. This is not the recurrence rate for this hospital, as very few of these patients had been operated on here previously. It represents a cross section of the work done by many surgeons throughout the country, and I believe that this is the most reliable way of arriving at a normal recurrence rate.

Statistics show that about 65 per cent of the inguinal herniæ recurring do so within the first six months, 80 per cent within the first year, and 6½ per cent after two years.

CAUSE OF RECURRENCE

Moschowitz (9) has tabulated the causes of recurrence as follows:

- A. Proper operations improperly done.
- B. Improper operations properly done.
- C. Improper operations improperly done.

If we are to accept this as a working basis, then all recurrences are chargeable to the surgeon. Other writers have laid stress on the following causes:

1. Wound infection.
2. Failure to get all of the sac.
3. Failure to find the associated direct sac during operation for an indirect hernia.
4. Approximation of the muscles and fascia under tension.
5. Inadequate reinforcement of the defective abdominal wall.
6. Using a single "standard" method in operating upon all cases.
7. Failure to unite the internal oblique to the inguinal ligament low down.
8. Leaving fat along the cord.
9. Injury to the inguinal nerves.
10. Leaving the internal ring too large.
11. Failure to maintain the obliquity of the inguinal canal.
12. Patients in which there is poor physical development, anemic fat streaked muscles.
13. Postoperative vomiting, violent coughing, and persistent hiccoughs.
14. Returning to hard labor too soon.
15. Some state that in tying knots too tightly that they cut through, while others say that knots must be tied tightly, as union only takes place by the formation of scar tissue.

TYPES OF OPERATIONS

Any operator who neglects to take into account the difference in anatomy of the direct and indirect herniæ and tries to make all of

his repairs by a single "standard" operation will surely have a high recurrence rate. It is also believed that any operator who neglects to get all of a sac or fails to find and remove the hidden part of a saddlebag sac is bound to have many failures no matter what type of muscle repair he does.

Why is it that a patient operated upon for an indirect hernia returns in a few months with a direct sac? Is it because the inguinal floor was injured at the time of the repair or did the operator fail to find the associated small direct sac?

The following typical case is cited: Seaman, 34 years of age, was operated on in June, 1928, for a large indirect inguinal hernia by the modified Bassini method. Four months later he returned with a so-called recurrence, which at operation proved to be a small direct sac. There is not the slightest doubt in my mind but that this small direct sac was missed at the first operation. This really should not be listed as a recurrence, but should be scored as an error for the surgeon. In this series of cases saddlebag sacs were present in 14 per cent of the primary and 8 per cent of the recurrent herniæ. It has been my experience that most of the so-called saddlebag sacs are made up of a major indirect sac and a minor direct sac; however, just the reverse occasionally exist. I have never experienced any difficulty in converting these two sacs into one by opening the major sac and introducing the index finger of one hand into it, then by wiping with a gauze sponge with the opposite hand at the neck of the sac, either mesially or laterally, depending upon whether the major sac is an indirect or direct one, the smaller sac comes into view and the two are amputated as one sac.

I have made it a practice for years in dissecting out a direct sac, no matter how small it is, to always visualize the bladder and strip the redundant peritoneum off of it so that it falls back out of the way. This permits higher ligation of the sac. I have never seen any harm done to the bladder in carrying out this procedure.

I doubt if it is ever necessary to transplant the stump of a sac; in fact, I feel that it is poor practice to do so, as it is apt to make one careless in getting all of the sac. I have seen one near disaster from this practice. In this case the operator anchored the stump high up and made the usual muscle repair and closed the skin. He then proceeded to repair the hernia on the opposite side, and much to his surprise, upon opening the sac, fresh blood welled up out of the peritoneal cavity. The first incision was immediately opened up and the bleeding was found to be coming from the stump of the sac from which the ligature had been pulled by the traction of the transplantation.

Now that the sac or sacs, as the case may be, have been completely removed, what type of muscle repair, if any, are we going to employ? Russell (10) states that the ordinary congenital type of indirect hernia is never due to muscle weakness and that a high removal of the sac without any muscle repair will effect a cure. So far, in the adult, I have never been able to resist the temptation to do a muscle repair, even though at times I have considered it unnecessary. All things being equal I believe that in this type of hernia the simpler the operation the better. The modified Bassini operation is a decided favorite throughout the naval service, and as a whole is probably as satisfactory as any of the modern operations.

For the small direct hernia there probably is no better operation than that devised by Willys E. Andrews, providing the aponeurosis of the external oblique can be approximated to the inguinal ligament without being put under tension. Unfortunately there are many cases in which this is impossible. When this is the case, I believe then that the operation of choice is one that makes use of living fascial sutures rather than catgut.

The observations of Gallie and LeMesurier (11) reported in 1921, Oudard and Jean (6) in 1922, and Seelig and Chouke (12) in 1923 showed universal persistent failure to secure good union between muscle and the inguinal ligament. It appeared to make little difference whether absorbable or nonabsorbable suture material was used. It has been my experience in doing recurrent herniæ to find the internal oblique firmly adherent to the inguinal ligament in the region of the internal ring, but seldom firmly adherent to that ligament in its inner portion.

Hodgkins (13) says that repair of recurrent herniæ is primarily a suture problem despite the preponderance of recommendations for changing the anatomy of the inguinal canal. Any well-planned operation in which the sutures hold the muscle and aponeurosis together will prove successful.

MacArthur (14) in 1901 was the first to make use of pedunculated strips of fascia from the external oblique in the repair of hernia. Gallie and LeMesurier (11) in 1921 reported on 100 cases repaired by sutures taken from the fascia lata. Adair (15) in 1924 described the free use of fascial sutures derived from the external oblique, and Hodgkins (13) in 1928 described the use of small multiple strips from the anterior sheath of the rectus muscle. All of these operations are based upon the same principle, i. e., that of using living suture material.

We have preferred the Gallie operation to the others on account of the unlimited amount of suture material available. We have adhered strictly to the technique as described by the authors of the operation in their original report.

The same attention must be paid to the sac and reformation of the anatomy of the parts as when using catgut suture material if the best results are to be obtained.

The sliding hernia presents real problems. In some of the smaller ones a complete sac can be developed. In the larger ones, however, this is usually not the case. Bevan (16) has recently described an invagination method of handling the sac which is theoretically good. In the one case in which I have tried it the neck of the sac was so narrow that the contents of the sac could not be forced through it by this invagination method.

Whatever the type of repair, I believe that the obliquity of the canal should be maintained and that any operation that allows the cord to come directly through the abdominal wall is defective in principle.

Probably the most difficult type of hernia to cure is the one in which there is a badly frayed inguinal ligament or one where the ligament is practically entirely replaced by scar tissue. Coley (17) has recently reported a method of repairing the inguinal ligament with fascia lata strips which should be of assistance in handling this type of case.

POSTOPERATIVE VENTRAL HERNIA

The problem of postoperative ventral hernia, I believe, is entirely one of suture material. It is not always the large ventral hernia that recurs after operation. I have in mind several small ventral herniæ that were repaired by the imbrication method of Mayo, all of which healed without infection, but promptly recurred, so that now I feel that every ventral hernia calls for a Gallie repair. Many of those monstrous herniæ that formerly were considered inoperable can be cured by this method.

In my experience the most difficult ventral hernia to cure is the one in the right lower quadrant where there has been prolonged drainage through the linea semilunaris. Much of the fascia and muscle has sloughed away, and what remains is atrophic and retracted. In this type of hernia lacing back and forth across the defect with fascia lata sutures will usually bring about a cure.

FEMORAL HERNIA

This type of hernia does not frequently recur if the sac is amputated high up. However, as a matter of precaution, I have recently been repairing the femoral ring with a pedunculated strip of fascia taken from the external oblique aponeurosis. This is merely applying MacArthur's principle to femoral hernia.

EPIGASTRIC HERNIÆ

These herniæ are usually small, but do recur at times. More recently I have been repairing them with a pedunculated strip of fascia taken from the anterior sheath of the rectus muscle.

UMBILICAL HERNIÆ

Present no special problem. The small ones may be repaired in the same manner as the epigastric herniæ described above, and the larger ones certainly should be repaired with fascia lata.

TABLE 5**TYPES OF REPAIR IN INGUINAL HERNIÆ**

	Modified Bassini	Willys E. Andrews	Warbasse	Fascia lata (Gallie)	Hodgkins
Primary.....	594	39	2	4	0
Recurrent.....	16	2	0	57	1

TYPES OF REPAIR IN VENTRAL HERNIÆ

	Overlap with chromic gut (Mayo)	Fascia lata (Gallie)
Postoperative.....	18	33
Epigastric.....	17	2
Umbilical.....	4	1

TYPES OF REPAIR IN FEMORAL HERNIÆ

Combined femoral and inguinal route with closure of femoral ring with chromic cat-gut.....	6
As above with closure of femoral ring with a pedunculated strip of fascia taken from the aponeurosis of the external oblique.....	4

TABLE 6.—Types of anesthesia used

Field block (procain 0.5 per cent).....	655
Spinal (novacain).....	142
Nitrous oxide, oxygen, and ether.....	3
Spinal and local infiltration and ether.....	1

TABLE 7.—Age distribution

Patients ranged from 17 to 72 years in age. They grouped as follows:

	Per cent		Per cent
Under 21.....	2.8	41 to 50.....	14.5
21 to 30.....	17.6	51 to 60.....	7.8
31 to 40.....	56	Over 60.....	1.3

TABLE 8.—*Preoperative complications*

Strangulation was present in 1 inguinal, 1 paraduodenal, and 2 femoral herniæ. Intestinal obstruction due to peritoneal adhesions was present in 1 ventral hernia; 24 cases showed 4 plus Kahns. The presence of syphilis appeared to make no difference in wound healing.

TABLE 9.—*Other operations performed at the same time the herniæ were repaired*

Appendectomy	77
Varicocelectomy	10
Excision hydrocœle of cord	8
Bottle operation for hydrocœle	7
Excision varicose veins of leg	2
Orchidectomy for undescended testicle	1
Bevan operation for undescended testicle	1
Excision of Meckel's diverticulum	1

TABLE 10.—*Postoperative complications*

Respiratory tract:		Wound infection:	
Bronchitis, acute	18	Inguinal—	
Pneumonia, lobar	1	Mild	33
Atelectasis (massive collapse)	8	Severe	3
Pleurisy, fibrinous	3	Ventral—	
Embolism	1	Mild	5
Tonsillitis, acute	2	Severe	3
Gastrointestinal tract:		Epigastric, mild	2
Paralytic ileus	8	Sporotrichosis infection	1
Paralytic ileus with atelectasis	1	Hematoma of wound	9
Intestinal hemorrhage	1	Hemorrhage (fifth day)	1
		Swelling of testicle	4
		Malaria	1
		Catheterization (repeated)	13
		Headaches (spinal anesthesia)	2

TABLE 11.—*Operative deaths*

There were 5 postoperative deaths, all occurring in patients that had been operated upon for primary inguinal hernia—3 for unilateral hernia, 1 for bilateral, and the other for bilateral hernia and appendectomy.

Cause of death was as follows:

Paralytic ileus	2
Paralytic ileus and atelectasis	1
Pneumonia, lobar	1
Embolism	1

FOLLOW-UP STUDY

Unfortunately this hospital is not equipped with the well-developed follow-up system that many of your civilian hospitals have. We must therefore depend almost entirely upon the information contained on the questionnaires sent out. Experience has led

us to believe that at times this information is anything but reliable. For instance, one patient wrote in that his hernia had recurred and came in a few days later for examination and showed no signs of recurrence. It is expecting a little too much of human nature for a man who has been drawing Government compensation for years on a hernia to admit that his hernia has been cured and suffer the withdrawal of his monthly check. You in civil life probably have the same problems to contend with in your workmen's compensation cases.

No follow-up study has yet been attempted in the primary inguinal hernia group. The patients in the recurrent group reported on having been operated on from six months to two and one-half years. There were 30 answers from patients operated upon by the Gallie method for recurrent inguinal hernia, 29 of which reported cures, and one stated that his hernia has recurred. However, he also stated that the Veterans' Bureau had discontinued his compensation, so I think it possible that he has no evidence to show that his hernia has recurred. The one case repaired by the Hodgkins method reported a cure. Of the 16 recurrent cases where operation was performed by the modified Bassini method, only 2 patients answered, one stating that he had a cure and the other a recurrence.

Of the 18 Mayo operations for the repair of postoperative ventral hernia, 8 patients answered; 3 reported cures, and 5 had recurrences. Three of these five recurrences have since been repaired by the Gallie method in this hospital, with a cure in each case. Of the 38 Gallie operations for ventral herniæ, there were answers in 14 cases, 11 of which reported cures and 3 recurrences. One of these recurrences was due to a severe postoperative wound infection, another undoubtedly to faulty technique, and the third cause undetermined.

Gallie and LeMesurier (11), in their original report on 100 cases, stated that none of their patients made complaint referable to the thigh from which the fascia sutures had been taken. This has been my experience, too, as patients convalescing about the hospital practically never complain of the thigh. However, out of the 45 patients answering the questionnaires who had had Gallie operations, 22, or practically one half, complained of such symptoms as "lameness," "numbness," "pain on change of weather," "sensitivity at times," "leg gets weak at times," "feels cold and painful," and "itching." One patient, whose hernia has been cured and compensation discontinued, has now put in a claim for compensation based on the scar of the thigh. Many of our operations have been on decidedly neurasthenic individuals, which may account for some of these complaints.

SUMMARY

1. The percentage of recurrences following the modern operations for hernia is still high.
2. Cure can only follow the complete eradication of all sacs.
3. Each hernia should be regarded as a problem in itself and the operation made to fit the patient rather than the patient to the operation.
4. Recurrent inguinal and postoperative ventral herniæ are chiefly suture problems.
5. The use of living fascial suture material in these herniæ will give a much higher incidence of cure than other types of suture material.

BIBLIOGRAPHY

- (1) Coley, W. B., and Hoguet, J. P.: Analysis of 8,589 Cases of Radical Operation for Hernia. *Ann. of Surg.*, vol. 68, p. 255, 1918.
- (2) Coley, B. L.: Three Thousand Consecutive Herniotomies. *Ann. of Surg.*, vol. 80, p. 242, 1924.
- (3) Taylor, A. S.: Results of Operations for Inguinal Hernia Performed in Johns Hopkins Hospital from January 1, 1899, to January 1, 1918. *Arch. Surg.* 1: 382, September, 1920.
- (4) Erdman, S.: Late Results in 978 Traced Cases of Inguinal Hernia in Male. *Ann. of Surg.*, vol. 77, p. 171, 1923.
- (5) Lyle, H. H. M.: Fascial Sutures. *Ann. of Surg.*, 88: 870-873, November, 1928.
- (6) Oudard and G. Jean: Hernies Inguinales Recidivees, *Rev. de Chir.* 60: 143, 1922.
- (7) Darling, H. C. Rutherford: Recurrence; Its Causation and Prevention. *M. J. Australia* 2: 151-158, July 30, 1927.
- (8) McEachern, J. D.: Method of Repairing Inguinal Hernia with Living Sutures Taken from External Oblique Tendon. *Ann. Surg.* 79: 758-761, May, 1924.
- (9) Moschowitz, A. V., and Neuhof, H.: The Relation of the Iliohypogastric Nerve to the Radical Cure of Inguinal hernia. *Ann. Surg.*, vol. 66: 79-87, 1917.
- (10) Russell, R. H.: Inguinal Hernia and Operative Procedure. *Surg. Gyne. and Obst.* 41: 605-609, November, 1925.
- (11) Gallie, W. E., and LeMesurier, A. B.: Living Sutures in Operative Surgery. *Canadian M. A. J.* 11: 504, July, 1921.
- (12) Seelig, M. G., and Chouke, K. S.: Fundamental Factor in Recurrence of Inguinal Hernia. *Arch. Surg.* 7: 553-572, November, 1923.
- (13) Hodgkins, E. M.: Use of Fascial Strips in Repair of Recurrent Hernia. *New England J. Med.* 202: 797-802, April 24, 1930.
- (14) Mac Arthur, L. L.: Autoplastic Suture in Hernia and Other Diastases. *J. A. M. A.* 37: 1162, November, 1901; 43: 1039, October 8, 1904.
- (15) Adair, F.: Use of Aponeurosis of External Oblique as Source of Living Suture for Inguinal Herniotomy. *J. A. M. A.* 82: 629-630, February 23, 1924.
- (16) Bevan, A. D.: Sliding Hernias of the Ascending Colon and Cæcum, the Descending Colon and Sigmoid, and of the Bladder. *Ann. Surg.* 92: 754-760, October, 1930.

(17) Coley, B. L.: Reconstruction of Poupart's Ligament. J. A. M. A., vol. 94:1660, May 24, 1930.

(18) Hodgkins, E. M.: New Method of Herniorrhaphy with Living Fascial Sutures Obtained from Rectus Sheath. Surg. Gyne. and Obst. 47:831-835, December, 1928.

A GLANCE AT RESULTS OF THE "LAST THIRTY CENTURIES" OF
VENEREAL-DISEASE PREVENTION

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For many centuries before the Christian era and throughout the ages down to the present man has attempted to limit the spread of venereal diseases by restrictive and punitive measures. We will describe a few of these attempts from different ages in order to show that the means taken to limit contagion has in most instances defeated the very purpose for which the restraints were imposed. Herodotus in Book One, article 138, states that the Medes and Persians imposed the following hardships upon any who contracted these diseases: "The citizen who has leprosy or the white sickness² may not come into a town or consort with other persons. They say that he is so afflicted because he has sinned in some wise against the sun. Many drive every stranger who takes such a disease out of the country." This method of handling leprosy and syphilis (when showing its worst forms) obtained throughout Bible times and on down through the Middle Ages with slight modifications.

One example of these restrictive measures as applied during the Middle Ages is that of the statutes promulgated by "Jane the I, Queen of both the Sicilies and Countess of Provence, for the regulation of the publick stews established at Avignon in 1347." (Quoted in its English translation only from Astruc, V. I, pp. 53 and 54.)

I. On the 8th of August in the year 1347, our good Queen Jane gave leave that a publick Brothel should be set up at Avignon, and order'd that the wenches, who ply'd there, should not walk the streets, but keep themselves confin'd within the Brothel, and by way of distinction wear a red knot upon their left shoulders.

II. If any Girl has thus offended and persists in her offence, that then the Claviger, or chief of the Beadles shall lead her thro' the City by beat of drum, a red knot hanging on her shoulder, back to the Brothel, and shall prohibit her from walking abroad any more under the penalty of being lasht privately for the first offence, and of being whipp'd publickly and turn'd out of the house for the second.

III. Our good Queen orders that this Brothel shall be erected in Broken-bridge street near the Convent of the Augustine Friars as far as to Peter's-gate; and that the entrance shall be towards the street, and the door lock'd,

²The "white sickness" included a number of diseases such as albinism, leukoderma, achromia parasitica, psoriasis, the leprotic macular eruption, and psoriaform syphilides, especially when accompanied with alopecia.

that no youth may have admittance to the wenches without leave from the Abbess or Governess, who is to be chosen every year by the Directors. The Abbess is to keep the key and advise the young men she admits to make no disturbances, nor frighten the wenches, and to let 'em know that in case of misdemeanour they will not be suffer'd to go off securely, but be laid under confinement by the Beadles.

IV. The Queen commands, that on every Saturday the Women in the house be singly examin'd by the Abbess and a Surgeon appointed by the Directors, and if any of 'em has contracted any illness by their whoring, that they be separated from the rest, and not suffer'd to prostitute themselves, for fear the youth who converse with 'em should catch their Distempers.

One hundred and fifty years after the statutes of Jane, just referred to, James the Fourth (1472 to 1513), who was king of Scotland from 1488 to his death, promulgated on September 22, 1497, because of the rapid spread of the grandgor (syphilis), in the city of Edinburgh, the following order:

It is our Soverane Lords Will and the Command of the Lordis of his Counsale send to the Provost and Baillies within this bur' that this Proclamation followand be put till execution for the eschewing of the greit appearand danger of the infection of his Leiges fra this contagious sickness callit the Grandgor and the greit uther Skayth that may occur to his Leiges and Inhabitans within this bur'; that is to say, we charge straitly and commands be the Authority above written, that all manner of personis being within the freedom of this bur' quilks are infectit or hes been infectit uncurit with this said contagious plage callit the Grandgor, devoyd, red and pass fur' of this Town and compeir apone the sandis of Leith at ten hours before none and thair sall thal have and fynd Botis reddie in the havin ordanit to them be the Officeris of this burt reddely furneist with victuals to have thame to the Inche (an Island in the Frith of Edinburgh over against Leith), and thair to remane quhill God proviyd for thair Health: And that all uther personis the quilks taks upon thame to hale the said contagious infirmitle and taks the cure thairof that they devoyd and pass with thame sua that nane of thair personis quhilks taks sic cure upon thame use the samyn cure within this bur' in pns nor peirt any manner of way. And wha sa beis foundin infectit and not passand to the Inche as said is be Mononday at the Sone ganging to, and in lykways the said personis that takis the sd cure of sanitle upon thame gif they will use the samyn thal and ilk ane of thame salle be brynt on the cheik with the marking irne that thal may bekennit in tym to cum and thairafter gif any of tham remainis that thal sall be banist but favors.

(Phil. Trans. IX, p. 213: An extract from the Books of the Town-Council of Edinburgh, relating to a Disease there supposed to be Venereal, in the year 1497, by Mr. Macky, Professor of History at Edinburgh, No. 469, p. 420. Read March 17, 1742-3.)

It is believed that little real progress has been made in restricting the spread of venereal diseases and what progress has occurred is due to (1) better knowledge of the pathogeny and treatment and dangers of venereal diseases; (2) gradual elevation of public morals concerning matters of sex, and (3) greatly improved conditions of personal hygiene among civilized races. The improvement can not, except in a few instances (e. g., among groups such as sailors and

soldiers) be attributed to governmental measures of control. Among the peoples of the earth to-day all systems of prevention are represented from that of the Medes and Persians through those of Queen Jane I and King James IV to those of the highest civilizations.

The defeat of direct preventive laws is due in our opinion to the following causes: (1) Disadvantages accruing to the infected individual either in money loss or because of enforced curtailment of his vicious habits; these put a price upon concealment; (2) difficulties of diagnosis, both of the particular disorder and of the state of its infectiousness; (3) the tendency of the human being to make an exception of the venereal diseases so that, contrary to what obtains with other dangerous infections, the menace from the carrier is not surely and adequately handled. The unfortunate person who is infected is treated not as a patient but as a defendant in court.

During the summer of 1930 the writer had an opportunity to see something of the system of control of the venereal diseases now being perfected in Germany, and as this system offers several new and radical departures from those which have prevailed for centuries, it is thought that a description of it may prove of interest.

In order to get a point of departure, we will compare the figures showing damage to the personnel of the United States Navy during the six years from 1924 to 1929, inclusive, with the curves for the German Navy from 1908 to 1928. See charts 1 and 2.

In answer to questions as to the number of our States having compulsory reporting for venereal diseases and as to the efficacy of these laws, Asst. Sur. Gen. Taliaferro Clark, chief of division of venereal diseases of the Public Health Service, replied as follows:

Please be advised that the venereal diseases are reportable in all the States except Nevada and Pennsylvania, according to the information available in our division of sanitary reports and statistics. In so far as I am able to find out, there are no data available on the results of the operations of the State venereal disease laws and regulations. Because so many variables enter into the question, such as the funds and personnel available for States to operate under the provisions of such laws, no comparable or uniform results may be expected.

CHART 1.—*Summary of venereal-disease statistics, United States Navy, 1924-1929*

VENEREAL DISEASES (ALL FORMS)

Year	Average strength, Navy and Marine Corps	Admissions	Admission rate per 1,000	Total sick days	Non-effective rate per 1,000
1924.....	119,280	16,409	137.57	214,984	4.94
1925.....	115,391	14,604	126.56	188,417	4.47
1926.....	113,756	13,516	118.82	184,294	4.44
1927.....	115,316	15,253	132.27	198,529	4.71
1928.....	116,047	14,403	124.11	195,916	4.63
1929.....	117,388	14,968	127.51	204,110	4.76

CHART 1.—*Summary of venereal-disease statistics, United States Navy, 1924-1929—Continued*

GONORRHEA

Year	Average strength, Navy and Marine Corps	Admissions	Admission rate per 1,000	Total sick days	Non-effective rate per 1,000
1924	119,280	10,132	84.94	111,625	2.56
1925	115,391	9,114	78.98	105,356	2.50
1926	113,756	8,084	71.06	103,772	2.50
1927	115,316	8,227	71.34	108,354	2.57
1928	116,047	8,353	71.98	111,634	2.64
1929	117,388	8,776	74.76	121,685	2.84

SYPHILIS

1924	119,280	2,355	19.74	66,353	1.52
1925	115,391	2,261	19.60	59,469	1.41
1926	113,756	2,505	22.02	57,803	1.39
1927	115,316	2,833	24.57	60,128	1.43
1928	116,047	2,633	22.69	60,308	1.43
1929	117,388	2,540	21.64	55,220	1.29

CHANCROID

1924	119,280	3,922	32.88	37,006	0.85
1925	115,391	3,229	27.98	28,602	.56
1926	113,756	2,927	25.73	22,719	.55
1927	115,316	4,198	36.36	29,987	.71
1928	116,047	3,417	29.44	23,884	.55
1929	117,388	3,652	31.11	27,296	.64

Below is reprinted in full the German law, which has been in force since October 1, 1927:

1. Venereal diseases in the sense of this law are syphilis, gonorrhea, and chancroid, irrespective of the portion of the body on which the symptoms may appear.

2. Any person knowingly suffering from a contagious venereal disease or suspecting infection shall undergo treatment prescribed by a medical doctor approved by the German Government. It is the duty of parents, guardians, and others having legal rights over minors to see that the person committed to their charge suffering from a venereal disease shall undergo medical treatment.

Measures putting the law into effect provide that people with small means who have no rights to other medical treatment or who might experience economic disadvantages by making use of sickness insurance treatment shall be treated from official funds.

3. The carrying into effect of all the hygienic duties provided by this law has been transferred to bureaus of public health, which are as much as possible to cooperate with the information bureaus for people suffering from venereal diseases, the board of trustees, and all other bureaus for social help. It is the duty of the staff of the police to carry out so far as possible hygienic and social duties, especially those of the bureaus of governmental care for minors.

4. The competent bureau of health may ask from such persons as are suspected of suffering from a contagious venereal disease a doctor's certificate regarding their state of health; in special and exceptional cases, however, a

certificate made out by a physician, approved by the competent bureau of health, they may be made to undergo an examination by such a physician.

Upon demand of the examining doctor those suspects shall be required to furnish such a doctor's certificate from time to time.

Persons suffering from venereal diseases and being suspected as possible means of infecting others may be forced to undergo treatment, or to go to a hospital, if this should be necessary, in order to avoid a spreading of the disease.

No notice will be taken of anonymous denunciations.

Persons who accuse others of suffering from a venereal disease, giving their name, shall at first be questioned orally. Denunciations will only be accepted if sufficient data to prove the allegations are given.

If it should not otherwise be possible to carry into effect the measures given in sections 1, 2, force may be used. Medical treatments involving serious danger to life and health may only be used with the permission of the sick person. It is for the Government to decide which medical measures fall under this category.

5. A person having sexual intercourse while knowingly suffering from a contagious venereal disease shall be punished by imprisonment for 3 years if the court does not prescribe a severer punishment.

The lawsuit shall only be carried on in case a charge has been made. If the guilty person is related to the person who brings the charge, it may be withdrawn.

The prosecution loses its validity after 6 months.

6. A person who marries knowingly suffering from a contagious venereal disease or suspecting it, without having told the other person of it before the marriage, shall be punished by imprisonment for a period up to 3 years.

Action at law shall only be in consequence of charges duly brought forth, and may be withdrawn.

The prosecution loses its validity after 6 months.

7. Only physicians being approved by the German Government are allowed to treat venereal diseases and diseases or affections of the genital organs. It is forbidden to treat such diseases otherwise than in accordance with personal observation or to advise people as regards self-treatment by lectures, literature, illustrations, or representations. A person who treats another person in contradiction to section 1, or offers to treat other people by distributing pamphlets, illustrations, or representations in public, even if this is done in an ambiguous way, shall be punished by imprisonment of at least 1 year and by a fine, or either, at the discretion of the court.

A doctor offering in an unfair manner to treat the diseases named in section 1 shall receive the same punishment.

8. A person examining or treating another person suffering from a venereal disease shall inform this person of the nature of the disease and of the contagiousness, furthermore warning him of the provisions of paragraphs 5 and 6 of this law, and he shall furthermore give him an officially approved information sheet.

If the patient lacks the proper understanding to carry out the orders of the physician, the information, as well as the information sheet, shall be given to the person who has to take care of the sick person.

9. A person treating another person who is suffering from a contagious venereal disease shall inform the bureau of public health, mentioned in paragraph 4, in case the sick person should withdraw from medical treatment or observance, or if he will be of danger to other people by the character of his work or through his personal relations.

The superior State officials may order that notice shall be given to an information bureau (Beratungstelle) for people suffering from venereal diseases instead of to the bureau of health. Should, however, the sick person not follow the regulations of the information bureau, the information bureau shall bring this fact to the knowledge of the bureau of health.

10. A person belonging to the staff of the bureau of health (Gesundheitsbehörde) or to an information bureau (Beratungstelle) who, without being authorized, speaks about facts told to him by virtue of his official employment regarding the venereal disease of a person, or its cause, or other personal details of the people concerned, shall be fined, or punished by imprisonment up to one year.

A lawsuit shall only be carried on in case a motion has been brought forward. The motion may also be brought forward by the public health officials.

The disclosing is not considered without authorization if it is given by a physician occupied at a bureau of health or an information bureau or with the permission of such a physician to an official or to a person whose interest in the venereal disease of the sick person is justified for reasons of health.

11. A person announcing or advertising or exhibiting remedies, articles, or treatments, or publishing pamphlets, illustrations, or representations, even if in an ambiguous manner, at a public place for the sake of curing or improving venereal diseases, will be punished by imprisonment of up to six months and a fine, or with one of the two.

If there are no other regulations concerning the rights of the Empire or the State, the advertising or sale of such remedies or articles to physicians or drugstores, or to persons who have a legal right to bargain for these remedies or articles, or to scientific medical or pharmaceutical journals, shall not be punished.

12. Lectures, pamphlets, illustrations, and representations serving only to give information about venereal diseases, especially about their symptoms, shall not be punished as long as they do not conflict with paragraph 7 of the penal code.

13. The right to bargain for remedies or articles made to protect people from venereal diseases shall be dependent upon an official governmental examination. The Government may forbid the sale of articles not suitable for this purpose. It may further give instructions regarding exhibiting, advertising, or propagating of legal remedies or articles.

A person dealing in remedies or articles which have been according to section I, 1, excluded from public trade, shall be punished by imprisonment of up to 6 months and by a fine, or by one of the two. A person not following the instructions of section I, 2, shall be punished in the same way.

14. The following person shall be punished by imprisonment of up to one year, and by a fine, or with one of the two, if according to the instructions of the penal code, a more severe punishment is not inflicted:

(1) Any female who nurses an infant, though suffering from a venereal disease, and is aware of this fact, or ought to be aware according to the circumstances;

(2) Any person allowing a syphilitic child which is under his care to be nursed by another person than the mother, knowing that the child is suffering from that disease, or being bound to know of it according to circumstances;

(3) Any person allowing a child under his care and suffering from a venereal disease other than syphilis to be nursed by a person other than the mother, without previously having her informed personally by a doctor about the disease and the necessary precautionary measures, although he knew that the

child was suffering from this disease or ought to have known it according to circumstances, without informing the foster parents accordingly.

If the syphilitic child is nursed by a syphilitic female, or allowed to be nursed by a syphilitic female, this shall not be construed as a punishable offence.

15. The following person shall be punished by a fine of up to 150 marks or by detention:

(1) Any wet nurse nursing another than her own child, not being in the possession of a medical certificate issued immediately before entering upon her duty, and stating that she is not suffering from a venereal disease;

(2) Any person engaging a wet nurse for nursing a child, without making sure that she is in the possession of a medical certificate of the kind mentioned in No. 1;

(3) Any person who allows another female than the mother to nurse a child which is under his care, excepting in urgent cases, without previously being in possession of a medical certificate stating that there will be no danger for the wet nurse.

In cases concerning No. 14, 2, the regulations of section 1 will be dispensed with.

16. The penal code is hereby changed to read as follows:

I. Second and third section of paragraph 180 will read as follows:

The keeping of a brothel or a house resembling a brothel is considered as pandering.

A person who gives lodging to another person being 18 years of age, shall only then be punished according to section 1, if at the same time a profit is made out of it, or the person is urged or brought to prostitution.

(Section 1 of this paragraph reads as follows:

A person customarily or from self-interest assisting prostitution or by allowing or providing an occasion for prostitution, shall be punished for pandering by imprisonment of no less than one month. At the same time he may be fined 150 to 6,000 marks, and lose the rights and honors of a citizen, and may be put under police control. Mitigating circumstances may reduce the punishment to one day.

II. To No. 3 of paragraph 184 the following amendment is added:

(3a) A person who announces, propagates, or exhibits at a public place remedies and articles or treatment, serving precautionary measures against venereal diseases in a way hurting morals and decency.

(Without the amendment mentioned above, paragraph 184 reads as follows:

The following person shall be punished by imprisonment of up to one year and a fine of up to 1,000 marks, or by one of these punishments:

(1) A person who deals in, sells, or distributes obscene pamphlets, illustrations, or representations at a public place, exhibits them, or sets up or spreads them in another way, or manufactures them in order to publish them, or keeps them on storage for the same purpose, or announces or distributes them;

(2) A person who sells or offers obscene pamphlets to a person less than 16 years of age;

(3) A person who exhibits, announces, or propagates in public places articles made for impure use;

(4) A person who publishes certain advertisements with the intention of causing illicit intercourse.

Besides imprisonment the person may also be punished by loss of civil rights and honors, or may be put under police control.)

III. Paragraph 361, 6, will read as follows:

Any person who in public encourages or offers himself to prostitution in a way hurting morals and decency, or in a way molesting other people.

IV. To No. 6 of paragraph 361 the following amendment is added:

(6a) Any person practicing prostitution for profit in the neighborhood of churches or schools or places meant to be visited by children or young people, or in an apartment where children or young people between 3 and 18 years are living, or in a parish with less than 15,000 inhabitants, for which the superior officials of the country, in order to protect young people or public decency, have given special instructions.

V. In paragraph 362, section 3, 2, the words "in case of paragraph 361, section 6" are substituted by the words "in the cases of paragraph 361, sections 6 and 6a."

17. It is forbidden to make any reservations as to certain streets and houses in regard to lodgings which are going to be used for professional prostitution (baracking).

18. Instructions necessary for carrying into effect this law, especially concerning the cooperation between officials and organizations for social welfare, will be given by the superior officials of the country.

19. This law shall become valid on October 1, 1927. On the same date the regulations for the fight against venereal diseases dated December 11, 1918, and the regulations regarding care for soldiers suffering from a venereal disease dated December 17, 1918, are canceled.

German cities and communities all have bureaus of health and one or more information bureaus. Upon these fall the principal work of carrying into effect the provisions of the law. It will be seen from reading this draft of the law that the essentials of success are in it: (1) It discourages and penalizes concealment; (2) it encourages cooperation on the part of those infected; (3) it encourages exact diagnosis; (4) by reason of the booklets and literature furnished to all men and women, both those who are infected and those who are simply interested in knowing what every adult should know about such things, it is enlightening the masses about the most important group of diseases which the human race has ever had to contend with. There can be no success here without the intelligent and interested cooperation of the masses. If a study of the history of medicine ever pointed the way to success, it does so in regard to this group of diseases. The Persian method above referred to was not a method of prevention at all. It was simply a penalizing of the unfortunate victims of disease and passing the infections along to others. It is strange that such a system could have been in effect for so many centuries.

The regulations of Jane I, modified perhaps a bit, are in effect in some countries even at the present. This system is grossly unjust to the female partner of promiscuity. It pictured the "young men" who visited the "wenches" as more or less lily white. As a matter of fact, being the seekers, they are primarily the distributors of sexual diseases, and if there are to be degrees of punishment the man should get the severer. The "Edinburgh method" could not be used

at the present time because, with our more exact methods of diagnosis, it would "depopulate whole cities" and have a large part of the race "brynt on the cheik with the marking irne."

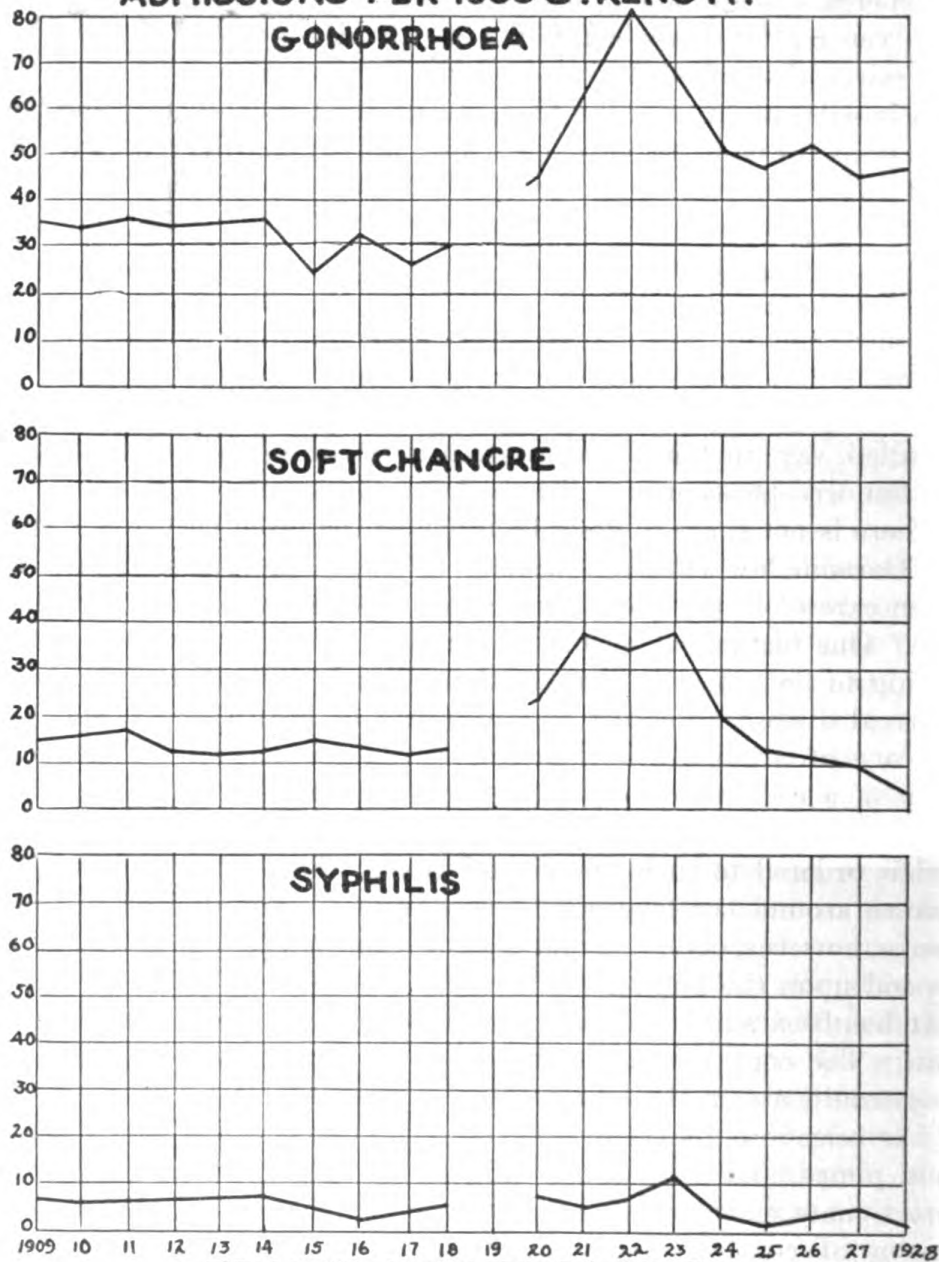
The Germans have shown the world how to lower the incidence of venereal diseases amongst the masses. They seem to have learned that venereal diseases constitute a "family problem." The law recognizes the principle wrapped up in the command: "Let him who is without sin cast the first stone," for the regulations and instructions carrying the law into effect preach chastity, but give the most exact and detailed instructions as to prophylaxis. The Germans seem to have lost all hope that the human being can ever overcome temptation in matters sexual. One may obtain condoms and prophylactic packets by simply placing a coin in machines designed for the purpose and pressing a button. These are conveniently arranged in railway stations and other public places. It is interesting to speculate upon the fate of such a piece of apparatus installed, say, in the Union Station in Washington, after some of our hundred-per-cent moralists had sensed its meaning.

There is not space to describe in detail the machinery for making the German law effective. Suffice it to say that these details are taken care of in the thorough manner characteristic of the German race. One feature which may be briefly described, however, is that having to do with the investigation of girls suspected of having a venereal disease. Reports to the bureau of health may come from any one of a number of sources regarding a suspect. The policeman on a certain section where a suspect lives, a boarding-house keeper or even the parent of the girl may turn in the report. The girl is ordered to turn up at the bureau, where every safeguard is thrown around her to protect her character. The desired information is, however, obtained, and the government's actions in the matter depend upon the findings.

It has been suggested that the above system might foster blackmail. The contrary is the case, for the controls are so good that they would nip in the bud any such attempt. Such official perfidy as has been recently uncovered in New York City, in which policemen, pimps, and magistrates united to "frame" young women for extortionate ends, would be utterly impossible under this German system of control. German youths, both male and female, are taught how to use sunshine, fresh air, public baths, and outdoor exercise to better the health and increase their resistance to disease. They know the benefits of temperate habits, and all these, taken with the system described above, are bound to lower the incidence of all types of venereal diseases.

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**ADMISSION RATES FOR VENEREAL DISEASES
IN THE GERMAN NAVY SINCE 1908
ADMISSIONS PER 1000 STRENGTH**



FROM STATISTICS OF THE
"REICHSWEHRMINISTERIUMS"

CHART II.—Breaks in curves between 1918 and 1920 due to postwar disorganization

of the American consulate in Dresden. Through his courtesy the laws, regulations, and instructions were translated into English. Vice Consul Charles M. Gerrity rendered much aid in showing the writer through the several units of the Dresden venereal diseases organization and in acting as interpreter. Wissenschaftlicher Direktor Professor Doctor Vogel, of the Deutsches Hygiene Museum, showed the writer many courtesies and furnished a complete set of photographs of the museum's exhibit upon the venereal diseases.

CANCER AS A FEDERAL PROBLEM

By E. L. WHITEHEAD, Lieutenant Commander, Medical Corps, United States Navy

Naval and military medicine is primarily concerned with safeguarding the health of our armed forces. It treats the usual acute and temporary injuries and diseases appearing in a body of essentially young and vigorous men picked for their physical fitness and health. It would seem that the cancer problem would never need serious consideration in such a service, and heretofore it has not played a very important part in the questions confronting the governmental medical services. Industrial and military hazards, tropical and venereal diseases, epidemiological and preventive medicine, are examples of scientific problems inherent and especially pertinent to the medical arms of the Federal organizations. The occasional patient with malignant disease is a subject for individual interest and pity rather than a demand for bureaucratic survey, organization, and concern.

There is a rather general though ill-defined feeling not only in the service but throughout the profession in general that the cancer patient is somehow both uninteresting and unprofitable; that he is inflicted with an incurable and unpleasant disease and must be cared for in some way, but that it would be preferable to have some one else care for him while so many other more interesting and responsive patients are at hand.

Now, however, the problem of malignancy, which is so insistently and progressively becoming a concern of medicine in civil life, is beginning to loom larger in the view of the medical services connected with the Federal Government, including them all in its scope. It would appear advisable to survey this approaching condition as a whole for efficient management rather than single out each individual patient as an occasional entity.

A brief statistical survey of conditions, both civil and official, is presented. Cancer (the term is used to include all malignancy) is now the second in frequency among the causes of death, contesting

first place with heart disease, which is really a miscellaneous category of pathological conditions. It has jumped to this position (in 1927) from sixth place in 1900 and has increased in frequency from 63 per hundred thousand to 96, or over 50 per cent, a gain not entirely explained by improved diagnosis and registration and the lowered infant mortality. (Figs. 1 and 2 (1).) This means that every year one person per thousand of population (at all ages) dies of cancer. Above the age of 21 the average military entrance age, about 1 out of 12, and at the age of 45, 1 out of every 8 will eventually be attacked by and probably die of this disease (2) (3).

The active naval service comprises about 115,000 officers and men. Added to this number for medical purposes is the retired list, naval pensioners, the Fleet Naval Reserve and continuous service men, the naval civilian employees, and the dependents of the entire naval personnel. There is probably an average of about one dependent for every other man on active service now legally entitled to medical aid and attention. The facilities for extending this attention are being increased and broadened every year, and theoretically if not practically, every case of malignancy of this total naval population of about 200,000 should pass through the hands of a naval physician for diagnosis, advice, treatment, or disposition. Of this 200,000 at least 200 will die every year of the disease, and as the duration of the average case is well over a year, about 400 cases of cancer are constantly present in the naval population and should be at least in contact with the Medical Corps. Add to this the sick veterans in the naval hospitals, now totaling over 3,000, all in the early cancer age, and many more tumor cases will be combined to the total. The proper handling of a group of about 500 cases of malignancy, even if not hospitalized, is a technical problem of no small magnitude for the Naval Medical Corps.

The other Federal services also must be considered. The Army, Public Health, and Coast Guard Services, with their attendant retired list, civilian employees, and dependents, will give another population of about 200,000 dependent on Federal medical aid and providing another group of approximately 500 cancer cases (4). Then comes the Veterans' Bureau and the huge mass of population which is entitled to its medical attention, comprising four to five million veterans, including those of the Civil and Spanish-American Wars. The great majority of these entered the World War between the ages of 21 and 31, making them now 34 to 44, or just at the beginning of the cancer age. At this age (average 39) the cancer deaths are 5 per cent of the total death rates. The average number of cancer deaths per 100,000 at this age is 40, making an expectancy of 1,600 deaths of veterans this year from cancer. (Fig. 3.) In

25 years the percentage will rise to 15 per cent of the total deaths at that age, or about 12,000 cancer fatalities in veterans in each year in the period 1950-1960. Of the entire group of 4,000,000 about 350,000 will eventually develop cancer (3). (See figs. 3 and 4.)

Each of these potential cancer cases will at some time demand from the United States Government, diagnosis, treatment, and hospital care, for the entire duration of the disease, ranging from a few months to several years. There is no doubt that our many influential veterans' organizations will see to it that this treatment is of the most thorough, modern, and scientific character. This is a staggering proposition, and while most of the load will be shouldered by the Veterans' Bureau and its institutions, it is more than probable that the Army and Navy hospitals will continue to carry their share. If in the future it is decided that a beneficent Government will extend medical aid to the dependents of veterans, as is not without the realm of possibility, this load will be doubled. There are undoubtedly several other categories in which Federal medical aid is available for civilians, such as Federal Government officials, civil-service employees under the Government services, the diplomatic and other Government services which have no medical corps, and the dependents of these various officials. In fact, the total number of the population of the United States under Federal medical care, will probably reach some seven million, or about 5 per cent of the total population of the country.

Thus it is seen that the cancer problem has an intimate interest, not only for the Navy Medical Corps in particular but for the Federal medical services as a whole. Our corps has a good-sized job to take care of its own cancer sufferers efficiently, and in addition will most certainly have a fair share of the tremendous number of veterans which will develop malignant tumors in the future and demand continuous treatment. Partial analogies to this problem may be found in the questions of tuberculosis and neuropsychiatric disease, both of which have caused the Veterans' Bureau no little trouble and study. In these, the number of cases have probably reached or passed the peak, whereas in the cancer situation, the task has only begun, and is sure to assume amazing proportions.

The question of meeting this present and growing need involves the survey of our present equipment and organization for the care of cancer patients, suggestions for possible improvement and efficiency and means of expansion, concentration, and organization to properly handle the inevitable influx of malignant cases the years will bring. Fortunately this same problem confronts the medical profession as a whole, and from the continuous studies and well-considered conclusions of the great cancer experts of the country,

may be extracted the policies which should guide the handling of cancer patients in either civilian or Government practice.

Two well-established principles in the management of malignant disease are so commonly known as to be axiomatic: (1) The possibility of the cure of cancer is in inverse ratio to the time the disease has existed before being recognized and adequately treated; (2) the only methods of proven value in the treatment of cancer are surgery, electrothermic destruction, X-rays, and radium (5) (6). While there are some other agents which give more or less promise of usefulness, none have advanced beyond the earliest experimental stage. There is at present no hope of a specific cure for cancer; all therapeutic progress is at present limited to the earliest and most efficient use of the methods we now have in hand.

Ewing presents the modern ideas in the following quotation from *The Medical Services Available for Cancer Patients in the United States* (6):

Cancer differs from many other major causes of death in the fact that, while fatal if uncontrolled, it is curable in a considerable proportion of cases if diagnosed early and treated by approved modern methods. The force of this consideration is not reduced by the fact that in many instances it can not now be diagnosed early or treated successfully. Early diagnosis and expert treatment thus become of far greater importance with cancer than with any other major cause of death.

When the field of cancer diagnosis is surveyed, it is found that this branch of medicine involves a great variety of procedures, instrumentations, clinical observations and experience, provided only by specialists in the various departments of medicine. Such diagnosis often requires an extensive list of laboratory procedures, which again can be provided only by those who have had considerable experience. The histologic diagnosis of tumors has always been recognized as a field requiring long experience in general histopathology and in the special pathology of tumors. The pathologist may no longer discharge his function by recording that the case is one of carcinoma or sarcoma. He is required to give a histogenetic diagnosis, to estimate, as far as possible, the grade of malignancy, and the grade of radiosensitivity, and to aid in making a clinical diagnosis and prognosis. Such information is required to guide the surgeon and radiologist in the choice and in the character of the treatment, as well as to offer a prognosis as to the probable outcome of any treatment.

All of these arms of service are rendered more difficult by the fact that cancer differs in important features, clinical and pathologic, in the different organs, and with the different cancers in the same organ, and more so than with any other major cause of death.

Finally, the introduction of new methods of treatment has transformed the field of therapeutics from a comparatively simple series of standard operations into a highly complex question of choice, involving deliberate conference between surgeon, radiologist and pathologist, all of whom should be familiar with the whole field of cancer therapeutics in general and with their own specialties in particular.

Under these circumstances we have been forced to conclude that the treatment of many major forms of cancer can no longer be wisely intrusted to the

unattached general physician or surgeon, or to the general hospital as ordinarily equipped, but must be recognized as a specialty requiring special training, equipment, and experience in all the arms of the service. We feel that the future development of cancer therapeutics will develop along the lines of concentration, organization, and specialization.

There are now eight naval hospitals that have the equipment, staff, and organization necessary to treat adequately cases of malignant disease. These hospitals have certain deficiencies which should be improved to make them equal in efficiency to the large modern city hospitals in this regard, and to meet the standards set forth by Ewing in the above quotation. These naval hospitals have, however, certain advantages inherent in a Federal organization, which are not obtainable in the usual civilian institution to such a marked degree. Of these advantages the following may be enumerated:

(1) Control of the patient to a degree far greater than is possible in any civilian service. This is very inclusive in its effects. It presupposes the constant medical supervision of the case before the onset of symptoms, their recognition at the moment of their occurrence, and the prompt transfer of the patient to the hospital without regard to his financial or social status. There an accurate and scientific diagnosis may be made and proper treatment instituted at the most favorable time. While the patient is at the hospital this diagnosis and treatment is not limited or delayed by his economic status, by gross incompetence of his doctor, by the patient's reluctance to take proper treatment, nor by the religious or medical beliefs of himself or family. All of these factors only too frequently block irretrievably the patient's welfare in civilian hospitals. The opportunity of following up the case is far greater in the service, either upon going to duty, or on leaving the Navy, with the help of the Red Cross social workers; or to autopsy, which is practically mandatory in service personnel. Statistical correlation of data is also possible to a degree unusual in outside institutions.

(2) Cancer authorities are in accord that efficiency demands group medicine in both diagnosis and treatment. The closest cooperation of surgeon, radiologist, and pathologist, with the other specialties concerned, as the internist, urologist, nose and throat, skin, gynecological, or other departments, is absolutely essential. It is believed that nowhere is group medicine practiced so consistently or efficiently, both in diagnosis and treatment, as in a service hospital. It is usually freer from internal politics, petty jealousies and cliques, financial squabbles, and worry about fees, 1-man dominance, parsimony as to matériel and equipment, and similar ills which frequently effect private diagnostic clinics, large hospitals, or endowed institutions. There is free consultation and general cooperation between

the various services, which is wonderfully valuable to the patient. The staff has more individual responsibility, freedom of ideas, and support from above than is usual in institutions built around one or several big men.

The service hospitals are somewhat less effective than civilian institutions as cancer centers in various points, many of which are inherent in a military establishment and for which no clear remedy is easily seen. For instance, the staff changes constantly, and a permanently stable organization is impossible. Each régime will carry out its own ideas, which may differ radically from those of its predecessors. Specialization to a degree practiced on the outside is hard to attain; interruption of special work by sea duty is inevitable, with more or less slumping of proficiency in a special field during the absence from it. Also, the primary mission of a naval hospital is to return patients to duty as soon as possible, and to rapidly eliminate the unfit; cancer patients are justly regarded as a drag on the machine.

Along certain lines, however, improvement is possible. Ewing (6) highly recommends for a general hospital the formation of a cancer service, not necessarily including the establishment of a cancer ward, but at least its own organization with a definite head, staff, records, and routine. At present the naval patient goes to a ward haphazard, depending on the location of his tumor or his presenting symptom. The responsibility for his treatment is thus given as a matter of more or less chance to whatever physician has the ward, and whose knowledge of the special field of malignancy is only average. The modern trend in cancer therapeutics is to gather all such cases under one man versed in the general subject of tumors, who will consult with the surgeon, radiologist, pathologist, and the other specialties concerned, evaluate all the information and recommendations received, and outline the combination of treatments his judgment dictates. A common mistake is to rely on only one mode of treatment, where in the majority of cases far greater results may be had by the judicious use of more than one form of the therapeutic measures at our disposal.

One deficiency in cancer therapy in our hospitals is the lack of radium. The question of radium has been frequently under discussion in the service, and often the subject is not fully understood. Radium and X rays are two forms of radiation having a beneficent effect on tumor tissue, which are very similar but have minor though striking differences. In some common forms of cancer, notably that of the stomach, radiation either from radium or X rays, is only occasionally of benefit. In many forms either radium or X rays may be used interchangeably, presupposing satisfactory quantity or

equipment. In some forms X rays are much more efficient, in some, radium is very much better; and in many cases radiation is many times more efficient if both X rays and radium are used together. The situation of the tumor, whether superficial, deep, or in relation to the body cavities, is the usual indication for deciding which mode of radiation is indicated; and the duty of determining the agent to be used and the method of application is the peculiar province of the radiologist (7).

The cases in which treatment by radium is obligatory are fortunately in the minority, but in these cases, the patient very definitely should have the benefit of that form of radiation. To do this it is not necessary that the Navy should at once equip each hospital with radium. This would be a very costly procedure, would take out of circulation a large quantity of that element for treating a few cases which is urgently needed by many, and in addition would be in incompetent hands, doing more harm than good, as no one in the service is sufficiently trained in its use to undertake its application without further study and experience. At the naval hospital in Brooklyn, the highest type of radium service is available for its patients at the Memorial Hospital. Neighboring naval units may easily transport their radium cases to that hospital. At the other Navy centers, radium treatment should be obtained by referring the patients to civilian radium specialists. Otherwise radium may be obtained by buying the emanation, which is relatively cheap, or by renting the element from one of the high grade companies organized for that purpose, providing the radiologist has the technical skill necessary. An occasional specialist's fee or a rental charge is far less expensive than the cost of radium itself, and the benefits of radium when indicated should never be denied a patient when it may be so easily obtained.

It is believed that no cases of malignancy should be treated in any manner at any other naval unit than these eight hospitals, if their transfer is at all feasible. A surgeon, a radiologist, and a pathologist, all should pass upon the case before any treatment is instituted, because, as noted by Ewing, "the first definite treatment a cancer patient receives usually determines the fate of that patient" (6), and all information possible should be at hand before that treatment is instituted, lest it be not only inadequate but harmful. A biopsy, for instance, may be actually fatal if the facilities for immediate radical treatment are not right at hand. Partial inadequate radiation under the theory that "it might be cancer" is also an example of noxious interference often practiced with dire results. In other words, the potentially curable patient has only one chance; it should not be spoiled by ignorance.

The cancer problem in a broad sense not only confronts the individual hospital, but is a matter for departmental and interservice inquiry. With the give and take of patients, especially out-patients, between the Army and Navy hospitals, and the large and growing number of veterans with cancer who gravitate between the Navy, Army, and Veterans' Bureau hospitals, a close cooperation between those medical services is highly desirable. As noted before, the tendency to equip a few large medical centers with all possible diagnostic and therapeutic aids, and a specialized staff and organization especially directed toward the care of malignant patients, is becoming more and more the dominant trend in the care of cancer. However, it is usually the exception to have a cancer patient, especially a veteran, remain at the same institution throughout the course of his disease. When he enters another hospital, his former medical history, complete with diagnosis, X rays, pathological slides, operative and other reports, should follow him at least as closely as the naval medical history follows the sailor. Nothing is more discouraging to both patient and physician than to have the patient appear with a scar or an X-ray tan, a vague history of an operation or a tumor, and to have to repeat the whole diagnostic process again, with no record of how much or how little has been done previously.

It is suggested that the appointment of a national board or commission to deal with malignancy, composed of members of the Army, Navy, Public Health Service, and Veterans' Bureau, would be a very valuable aid in the handling of the many cases of cancer, present and future, with which we may deal. Many functions could be handled by such a body. A tumor registry modeled after the Registry of Bone Sarcoma of the American College of Surgeons (8) might well be undertaken with very gratifying results, in which every case of tumor or allied conditions would be registered with section, X rays, operative findings, diagnosis, and history. Any cancer case leaving a service hospital and lost sight of is almost sure to turn up again at some other hospital in one or another of the services, and could be immediately taken up with all data easily available. Questionable pathological diagnoses, of which there are so many, could be referred with the original slides to leading tumor pathologists for opinions. Statistical and experimental studies on a scale never before possible could be made from the vast amount of material that would accumulate, and follow-up histories of patients, either through three and five year cures or to autopsy, would reach a percentage never equaled in civilian clinics not having the National Government and Red Cross network of agents at their disposal.

The board might take under its cognizance the establishment and standardization of cancer centers as before mentioned in various service hospitals at strategic points in the country, and the distribu-

tion and concentration of cancer patients at these centers. It could direct the training and specialization of medical officers interested in cancer work to make them more valuable for this purpose. The procuring and distribution of radium, including that already in possession of the Government and now in private hands, due to lack of trained Federal personnel and equipment, might well come under its control. Research into cancer problems, in which the Government has yet taken little active part, might be initiated under its direction. Official investigation of the merits of new methods advocated for the cure of cancer would be extremely valuable, both to control the spread of unscientific procedure and to give the stamp of official approval to those which give promise of usefulness. Its field of activity might be broadened to assist the Society for the Control of Cancer and the American Medical Association in their program of public education in this field. This has already shown gratifying results in the past few years by bringing cancer sufferers to the doctor in increasingly earlier stages of the disease.

In short, the cancer problem is a national one. At present the medical services of the Government have taken no active part in supporting the organized medical profession in their campaign against that disease, although their record is brilliant in many other fields. A central governmental body would aid, not only the individual in the service of the Government who unfortunately suffers from that malady, but would aid the naval hospital, the service, the profession, and the Nation at large.

A most excellent summary of this subject from the standpoint of the civilian medical profession appeared as an editorial in the American Journal of Röntgenology and Radium Therapy for December, 1930, entitled "Concerted Action in the Fight Against Cancer," by Dr. H. K. Pancoast, a nationally recognized authority in radiology (9). The following short quotation is of interest to Federal medical officers:

It is most gratifying to know that a semiorganized fight against malignancy has been started by a host of individual units. National, State, and local medical societies, and State and municipal health boards have had their interests aroused and are doing much good work. Even the Federal Government has shown signs of interest. Concerted action to bring about the greatest possibilities must originate from definite preconceived plans which have been worked out carefully and judiciously. Two medical groups, The American Society for the Control of Cancer and the Committee on the Treatment of Malignant Disease of the American College of Surgeons, have formulated basic plans which seem rational as a basis for future organized work. Their recommendation does not conflict with, but makes use of, the groups or individuals who are working on the cancer problem at the present time. The recommendations of the two bodies are quite similar in essential or major details.

Among all of the various organizations now actually engaged in the fight against cancer, and especially those doing research work, there is considerable duplication of effort. In order to obviate this waste of time, energy, and resulting expense a subcommittee of the Senate Committee on Commerce, during the last session of Congress, invited several men interested in cancer to meet with them for the purpose of formulating a bill for presentation to Congress authorizing the Surgeon General of the United States Public Health Service to make a survey of the entire subject similar to those made by the two medical organizations previously mentioned. Representatives from both organizations were present. Naturally, the Surgeon General's office would be a very valuable cooperative body and could act as a clearing house where valuable data would be available without duplication or expensive investigation.

An editorial in the Journal of the American Medical Association for February 14, 1931, entitled "Statistics on Cancer," also refers to the need for a central national board directed to the correlation of cancer statistics and the evolution of different forms of treatment (10). It says in part:

In a few years England will have excellent statistics on the treatment of cancer by radium. A national organization might undertake and enlarge on a similar plan in this country. There is apparently no correlation of results of treatment of cancer by radium in the various parts of our country. Physicians must rely on reports in the literature, which are frequently contradictory. A yearly report should be made, as is done in England. It could be enlarged to include the final results of all cases of cancer, whether treated by radium, X rays, or surgery.

Recent legislation in Congress has given the Public Health Service unusual scope and power in the domain of cancer investigation, which has had as yet little time to bear fruit. Also much has been done by the Veterans' Bureau in the establishment of large cancer centers, whose numbers are few and whose influence, while being efficient, is as yet local. The Army and Navy in single hospitals at New York and Washington have each partially developed a cancer center, which as yet hardly ranks with the large civilian cancer institutes because of the subordinate scope of those departments. The advantage of a central Federal organization combining the organizations and research facilities of the Public Health Service, the enormous clinical material offered by the Veterans' Bureau, combined with the Army and the Navy, as well as the chain of institutions already equipped and in operation belonging to those organizations, would seem obvious, and under a central body representing all these services the standardization of concentration, organization, and specialization would appear to be of great promise in this national struggle against such a dread disease.

SUMMARY

There is a large number of cancer patients in or dependent on the Navy and legally entitled to medical care.

There is a still greater number of Veterans' Bureau patients afflicted with cancer at present being treated in naval hospitals, and this number is mathematically certain to increase to great proportions within the next decade. This mass of patients will constitute a problem in diagnosis, treatment, and after care of greater extent than the tuberculous and neuropsychiatric aftermath of the Great War.

While the larger naval hospitals are able to care for the present cancer patients with satisfactory efficiency, certain suggestions are tentatively offered in the hope of improving the standards of treatment of malignancy in these hospitals and to look forward to the further problems which may arise if the future indicated increase in veteran cancer patients occurs.

There is a growing need for a central national medical organization directed toward the problem of cancer control, which is being recognized by the medical profession of the country, and which has already received official sanction in the recent proceedings of Congress. This need provides a valuable opportunity for the already well-organized Federal medical services.

SUGGESTIONS

(1) That each service hospital equipped to undertake the treatment of patients afflicted with malignant disease should have a malignancy board similar to that in vogue in the larger civilian hospitals. This board to consist primarily of a surgeon, a radiologist, and a pathologist, and to be headed by a physician acquainted with and interested in the general subject of malignancy, and to include the heads of the various special departments. It should pass on all cases of malignancy, either in the hospital or in the outpatient department, and the head should evaluate and outline the treatment of the various cases.

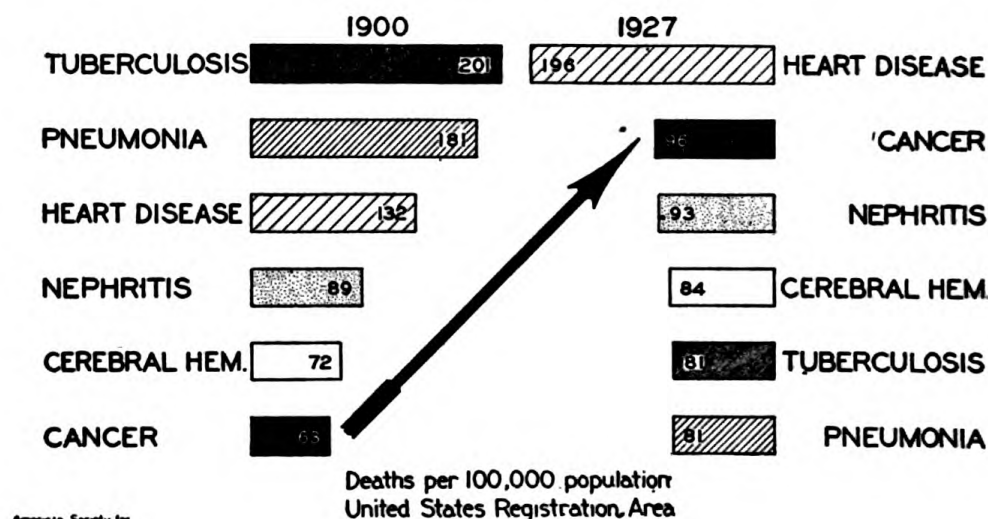
(2) That radium should be made easily available to those cancer cases in which its use is indicated in the judgment of this board.

(3) That a central Federal tumor registry should be instituted for the registration of all malignant tumors occurring in patients in the various Federal services, both for the benefit of the patients concerned, the information and education of the medical profession both within and without the service, and the value to the Nation in general from the increased knowledge of cancer that may be gained from such an institution.

(4) That a central advisory body be formed from the physicians of the various Federal services to aid the more efficient treatment of cancer patients in those services by concentration, organization, and specialization of the matériel and personnel, and to aid the medical

profession in their fight against cancer by providing an official governmental body to consider the problems of research, education, and the advancement of scientific knowledge on the subject of malignant tumors.

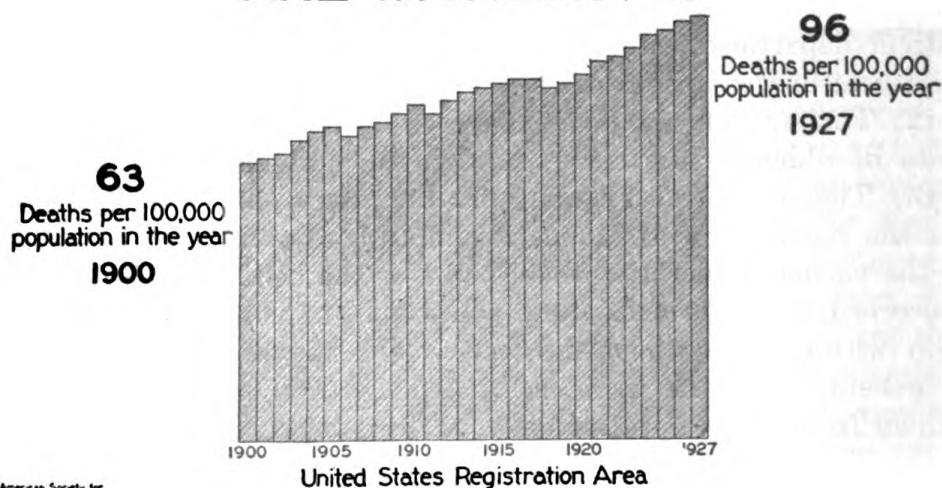
CANCER RANKS SECOND AS CAUSE OF DEATH



American Society for
the Control of Cancer

FIGURE 1

CANCER DEATHS ARE INCREASING



American Society for
the Control of Cancer

FIGURE 2

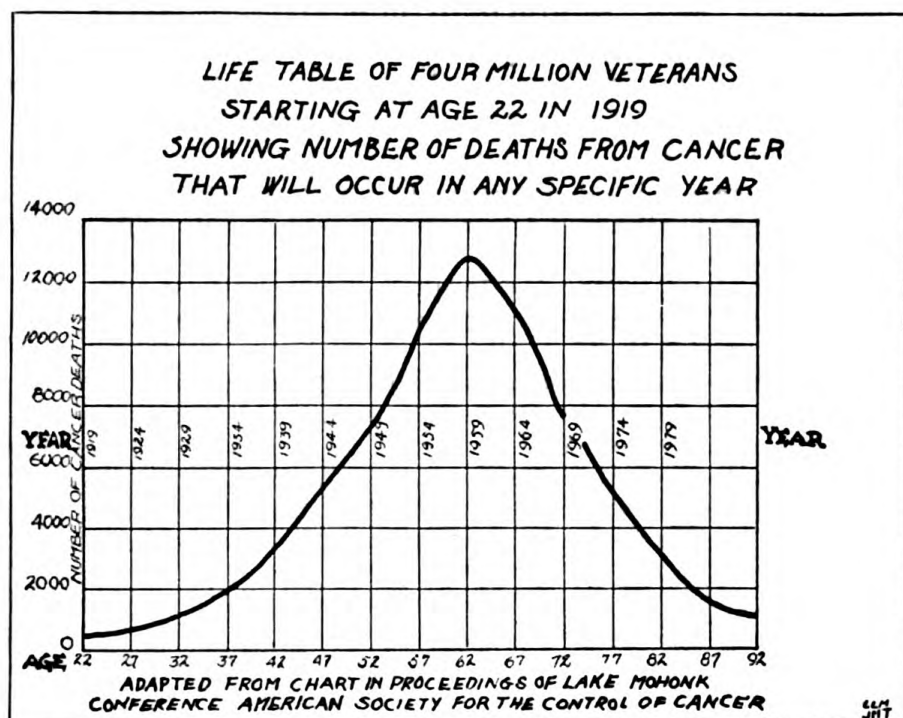


FIGURE 3.—This chart illustrates a "life table" of 4,000,000 males of age 21 showing the actual number of this original group that will die each year from cancer. Figures are from mortality statistics of American Registration Area for 1928, and of course do not take into account the marked increase in cancer mortality which appears to be occurring constantly

Calendar year	Number of veterans dying from cancer	Calendar year	Number of veterans dying from cancer	Calendar year	Number of veterans dying from cancer
1919.....	200	1944.....	5,200	1969.....	8,000
1920.....	200	1945.....	5,500	1970.....	7,000
1921.....	200	1946.....	6,000	1971.....	6,200
1922.....	300	1947.....	6,500	1972.....	5,700
1923.....	300	1948.....	6,900	1973.....	5,200
1924.....	300	1949.....	7,300	1974.....	4,700
1925.....	300	1950.....	7,800	1975.....	4,100
1926.....	400	1951.....	8,100	1976.....	3,800
1927.....	400	1952.....	8,800	1977.....	3,300
1928.....	400	1953.....	9,400	1978.....	3,000
1929.....	500	1954.....	10,000	1979.....	2,800
1930.....	600	1955.....	10,700	1980.....	2,600
1931.....	700	1956.....	11,300	1981.....	2,400
1932.....	900	1957.....	11,800	1982.....	2,200
1933.....	1,000	1958.....	12,100	1983.....	2,000
1934.....	1,500	1959.....	12,500	1984.....	1,800
1935.....	2,000	1960.....	12,300	1985.....	1,600
1936.....	2,300	1961.....	12,200	1986.....	1,400
1937.....	2,500	1962.....	12,000	1987.....	1,200
1938.....	3,000	1963.....	11,500	1988.....	1,100
1939.....	3,400	1964.....	11,200	1989.....	1,000
1940.....	3,700	1965.....	11,000		
1941.....	4,000	1966.....	10,500		
1942.....	4,500	1967.....	10,000		
1943.....	5,000	1968.....	9,000		
				Total.....	349,300

Figure 4. Translating the graph of Figure 3 into a column of figures giving the approximate number of veterans that will die of cancer in each specific year until 1989. It will be noted that a total of about 350,000 veterans may be expected to die of cancer according to present statistical calculation.

BIBLIOGRAPHY

Acknowledgment is made to the American Society for the Control of Cancer for the use of charts in Figures 1 and 2.

- (1) Coley, W. B.: Some Observations on the Problem of Cancer Control. (Editorial) *American Journal of Surgery*, 14: 668, June, 1928.
- (2) Hoffman, F. L. (Prudential Insurance Press): *The Mortality from Cancer Throughout the World*.
- (3) Dublin, L. J.: *The Chance of Death from Cancer; Cancer Control; The Proceedings of the Lake Monhonk Conference, 1928*, American Society for the Control of Cancer, p. 274.
- (4) Annual Report of the Surgeon General, U. S. Army, 1929.
- (5) Editorial; On Cancer Cures: *Bulletin of American Society for the Control of Cancer*, 12: 3, October, 1930.
- (6) Ewing, J., Greenough, R., Gerster, J.: The Medical Service Available for Cancer Patients in the United States. *Journal A. M. A.*, 93: 165, July 20, 1929.
- (7) Wood, F. C.: Radium and Röntgen Ray Therapy, *Journal A. M. A.*, 92: 802, March 9, 1929.
- (8) Codman, E. A.: Bone Sarcoma. (Paul Hoeber) p. 89.
- (9) Pancoast, H. K.: Concerted Action in the Fight Against Cancer. (Editorial) *American Journal of Röntgenology and Radium Therapy*, 24: 687, December, 1930.
- (10) Editorial; Statistics on Cancer: *Journal A. M. A.*, 96: 533, February 14, 1931.

A METHOD OF PRODUCING STERILE BLOWFLY LARVÆ FOR SURGICAL USE¹

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T. L. SMART, Pharmacist's Mate, First Class, United States Navy

The need for sterile blowfly larvæ in the treatment of chronic osteomyelitis, according to the method recently developed by Dr. W. S. Baer of Baltimore, has made necessary the study of problems which heretofore have received little if any consideration. Formerly, interest in the life histories and habits of the blowflies has centered principally around the possible relation of the flies to various diseases and the improvement of methods for fly control and destruction. Doctor Baer's use of larvæ now requires studies of just the opposite nature, directed as they are to the solution of two main problems—(1) the maintenance of a sufficient number of healthy fertile flies in the laboratory the year around, and (2) the establishment of such conditions that the larvæ will hatch in sterile surroundings and will be protected from subsequent contamination until used by the surgeon.

These problems have been studied during the past year at the United States Naval Medical School and a technique for the production of sterile larvæ developed which has been found to be both

¹ From the Department of Medical Zoology, U. S. Naval Medical School, Washington, D. C.

satisfactory and practical. Because of the many details and the short time this subject has been under investigation, it is to be expected that further experience will suggest modifications and improvements. Nevertheless it is felt that the reporting of this method at the present time will facilitate the extended clinical trial which Doctor Baer's treatment seems to warrant.

HISTORICAL

There are two events in the historical background of the relation of larvæ to wounds which are of particular interest.

Kelly (1), quoting Ambroise Paré (2), has noted the first recorded statement as to relationship between flies and disease. After the Battle of St. Quentin (1557) Paré "found the wounds excessively fetid and full of worms with gangrene and corruption; * * *. For more than half a league around the earth was covered with dead bodies, * * * we were the cause of a rising up from the bodies of a great number of large flies gendered by the moisture of the bodies and the heat of the sun; they had green and blue bellies and when they were in the air they cast a shadow on the sun. It was wonderful to hear them buzzing, and wherever they settled they made the air pestilent and there they caused the pest."

Larrey's "Memoirs" (1814) contains a description of the French campaign in Syria (1799), in which he notes that "During the progress of suppuration the patients were only troubled by worms or larvæ of the blue flies common in Syria, * * *. Although these insects were troublesome, they expedited the healing of the wounds by shortening the work of nature and causing the sloughs to fall off."

SPECIES OF LARVÆ USED

The larvæ used in this form of treatment are those which live only on dead tissue. These species are commonly known as "blowflies." Their classification and differential characteristics can be found in any standard work on entomology. We have investigated the *Lucilia sericata* (green bottle fly), the *Cynomyia cadaverina*, the *Calliphora erythrocephala* (blue bottle flies), and the *Phormia regina* (black blowfly). The *L. sericata* has proven the most satisfactory from the laboratory standpoint, but further studies are now in progress to determine if the other species possess clinical advantages, for it is possible that various types of infection may respond differently to larvæ of different species.

A word of warning will not be out of place at this point. The larvæ of the *Chrysomya macellaria* (screw worm fly) will feed on living tissue, even bone, and, if introduced into a wound, great destruction of tissue, and even death, may result. During the summer

months this fly is found throughout all but the extreme northern parts of the United States, and particular care should be taken to safeguard against its introduction into the breeding cages.

CHARACTERISTICS OF THE BLOWFLIES

For the sake of clarity, some of the more important characteristics of the blowflies will be discussed together at this time in order to obviate the necessity of interspersing much of an explanatory nature throughout the descriptions which follow.

In their metamorphosis, blowflies pass through four stages: (1) egg, (2) larva (maggot), (3) pupa (resembling a cocoon), and, (4) imago (adult), as shown in Figure 1. Under laboratory conditions the entire metamorphosis requires from 18 to 26 days. The eggs hatch within 10 to 24 hours. The larval stage consists of two periods: (a) The growing and feeding period of from five to seven days, during which the larvæ eat actively and are of surgical use. (b) The prepupal or inactive period, lasting six to eight days. During this latter period the larvæ work down into the sand preparatory to pupating. They do not eat and are therefore of no surgical use. The pupal stage lasts six to eight days and the pupæ are formed deep in the sand. The time required for the metamorphosis depends largely upon the temperature, high temperature hastening, cold retarding the changes. The fly lays her eggs in clusters on meat so that there will be an available food supply for the newly hatched larvæ. Each egg is covered with an albuminous coating which serves to hold the cluster together, as well as to attach it to the meat. The eggs are destroyed when they become dry.

The larvæ breathe through spiracles situated in their posterior extremity and require a supply of oxygen at all times. They will frequently try to escape from the containers during the prepupal period in an attempt to find fresh sand in which to pupate. If this tendency is noted in the incubator during the feeding period, it is usually because of an inadequate food supply. Larvæ being used surgically will leave the wound when they reach the prepupal period, or sooner if conditions are not favorable for their growth; such as the lack of food, or their inability to breathe in deep wounds due to lack of oxygen or the excessive accumulation of secretions. If larvæ are insufficiently fed, they will eventually pupate, but will emerge as small flies, which are very poor layers and worthless for breeding stock. (Fig. 2.) Larvæ from the same cluster of eggs do not all pupate at the same time. It is not unusual to find some larvæ still moving about in the sand three or four days after others have pupated.



ADULT



PUPA



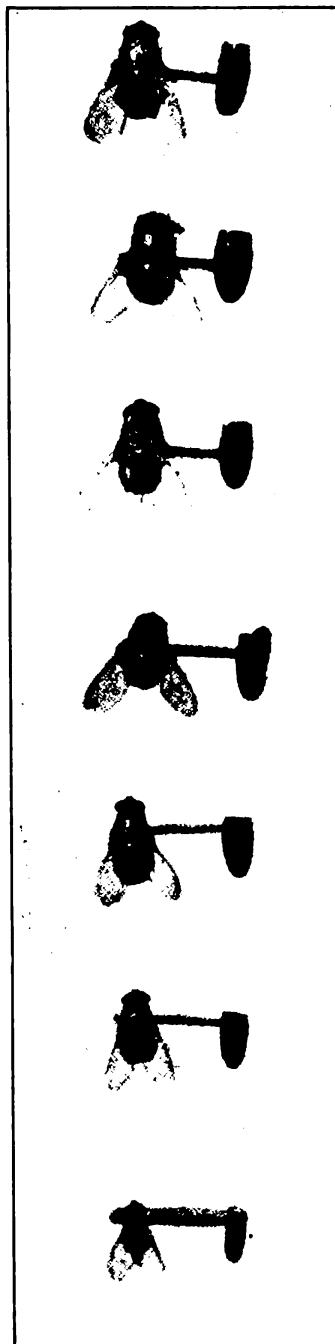
LARVA



EGG CLUSTER

LIFE HISTORY
OF THE
BLOWFLY

FIGURE 1



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**FIGURE 2.—ILLUSTRATING
THE EFFECT THAT
UNDERFEEDING THE
LARVA HAS ON THE SIZE
OF THE ADULT FLY**

Overfeeding, if it does not result fatally, does not increase the size of the fly over the optimum, as may be seen by the uppermost individual, which is the same size as the next lower individual or optimum. Each of the next lower individuals is the result of decreasing the time of feeding by six hours.—From William B. Herms, *Medical and Veterinary Entomology*.

Pupæ may be removed from the sand in which they have formed and are not injured by gentle handling. They do not require oxygen, so can be packed in closed containers and transported in this manner, provided the length of the pupal stage is not exceeded in transit.

Emerging occupies four to five days. Only males emerge during the first 24 to 36 hours, then both males and females, until the last day, when only females appear. The number of males and females are then about equal. For this reason the beakers containing pupæ should not be moved from one cage to another while the flies are emerging, for by so doing the proportion of males and females in the cages will be altered from the optimum of 1 to 1. Female blow-flies are easily distinguished from the males by the greater distance between their compound eyes. This shows as a light colored band between the eyes of the females, which is not seen in the males. Oviposition takes place within 4 to 5 days after the flies emerge and continues for about 30 days. Flies are attracted by light, so while working with the cages if the doors are turned away from the source of light only a few flies will try to escape. Larvæ on the other hand are repelled by light and when transferred to a tube they will crawl to the bottom if the lower half of the tube is wrapped with dark paper.

The larvæ begin eating as soon as hatched and if infecting organisms are present, either in the medium or on the eggs themselves, their intestinal tracts are immediately infected. This infection is continued through the larval stage and is transmitted to the adults, which in turn infect their cages and eggs. As was to be expected, our attempts to sterilize the intestinal tracts of the larvæ have been unsuccessful. It is, therefore, evident that the only point in the metamorphosis where sterilization is possible is the egg stage. We have worked on a technique for raising sterile flies in sterile containers, thereby obviating the necessity of sterilizing the eggs, but such a method is not considered practical for the average laboratory at the present time because of the very expensive special glassware and other equipment required.

MAINTENANCE OF BREEDING STOCK

Source of breeding stock.—Flies for breeding stock can best be secured from another laboratory, either as adult flies or pupæ. If such a source is not available, wild flies of the desired species must be caught during the warm months. These can be attracted by pieces of decaying meat placed out of doors. The females are captured about the meat with large test tubes. Each female is isolated in a small individual cage (fig. 3) and put in a warm, dark, quiet place. After oviposition, which will usually occur within 12 hours, the

females are killed in a cyanide bottle and identified. If one or more are found to be the desired species their eggs are sterilized and hatched. In this way a pure strain of a known species is obtained and can be continued almost indefinitely. Prolonged interbreeding does not appear to have a harmful effect. Wild flies are always heavily infected with spore-bearing bacteria. For this reason they should not be mixed with the breeding stock and their eggs not used unless sterilized.

Growing larvæ for breeding stock.—Larvæ which are to be used for breeding stock are grown in larvæ pots in the exhaust draft incubator. (Fig. 4.) Eggs from the breeding cages need not be sterilized before they are put in the pots. As each pot is to provide flies for but one cage (about 150), a spherical mass of eggs 0.5 centimeters in diameter is sufficient for each. During the feeding period of the larvæ, fresh meat is added to the pots daily, after first removing the remnants of the meat left from the previous day. If the larvæ have burrowed into the old meat so that they can not be brushed off, the fresh meat is placed beneath the old and within a few hours the larvæ will be found to have left the old piece, which can then be removed. During this period the sand is kept moderately moist. When the larvæ reach the prepupal period and cease to eat, no further meat is added and the sand is allowed to dry out. Toward the end of the pupal stage the muslin cover of the pot is replaced by a single layer of gauze. As soon as the flies start to emerge the contents of the pot is poured into a large sieve and most of the sand removed. The pupæ and the balance of the sand are poured into a 250-cubic-centimeter glass beaker and put into a freshly prepared cage. (Fig. 5.) Feeding dishes are inserted and the cage placed in the fly incubator. (Fig. 6.) When all the flies have emerged, the beaker with the pupæ shells is removed from the cage through the large hole in the right-hand side.

Care of breeding stock.—Flies require a well-balanced diet of high-vitamine content and an abundance of water at all times. The following method of feeding has proven very satisfactory. Three food dishes are used in each cage:

(a) *Water dish.*—This is a fountain-type dish. (Fig. 7.) The fountain is filled with water and the filter paper is kept wet at all times. Powdered glucose is sprinkled over the top of the fountain.

(b) *Fruit dish.*—This is also a fountain-type dish. The fountain is filled with a 2 per cent glucose solution. Orange juice is squeezed into the dish and pieces of orange, crushed raw pineapple, and crushed raw apple are laid on the filter paper around the fountain. A small amount of powdered glucose is sprinkled over the top of the fountain.

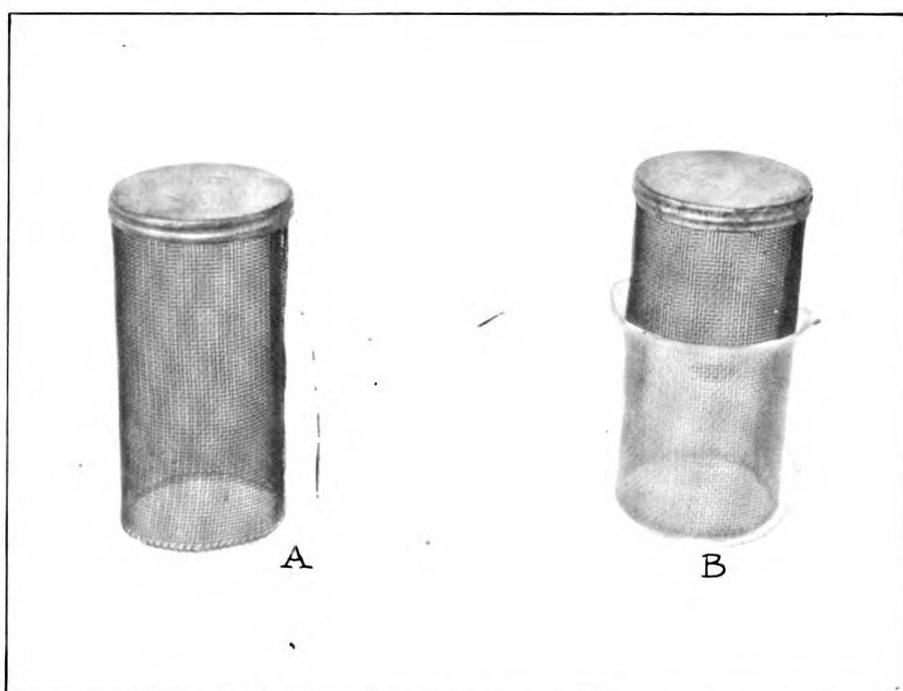


FIGURE 3.—SMALL CAGE USED TO OBTAIN EGGS FROM A SINGLE FLY



FIGURE 4.—EXHAUST DRAFT INCUBATOR FOR LARVAE
Larvae pots are seen on middle shelf.

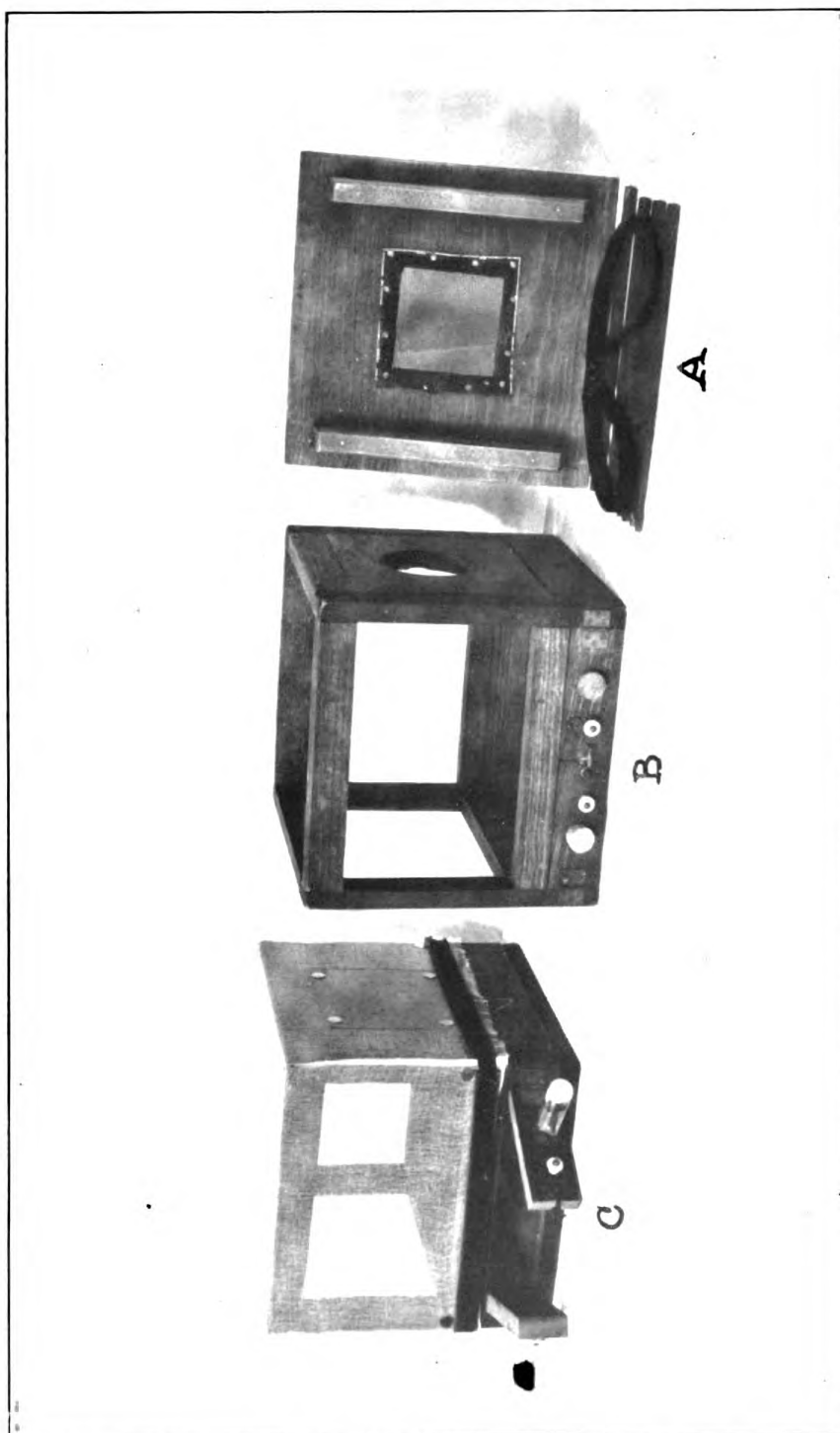


FIGURE 5.—CAGES FOR BREEDING STOCK

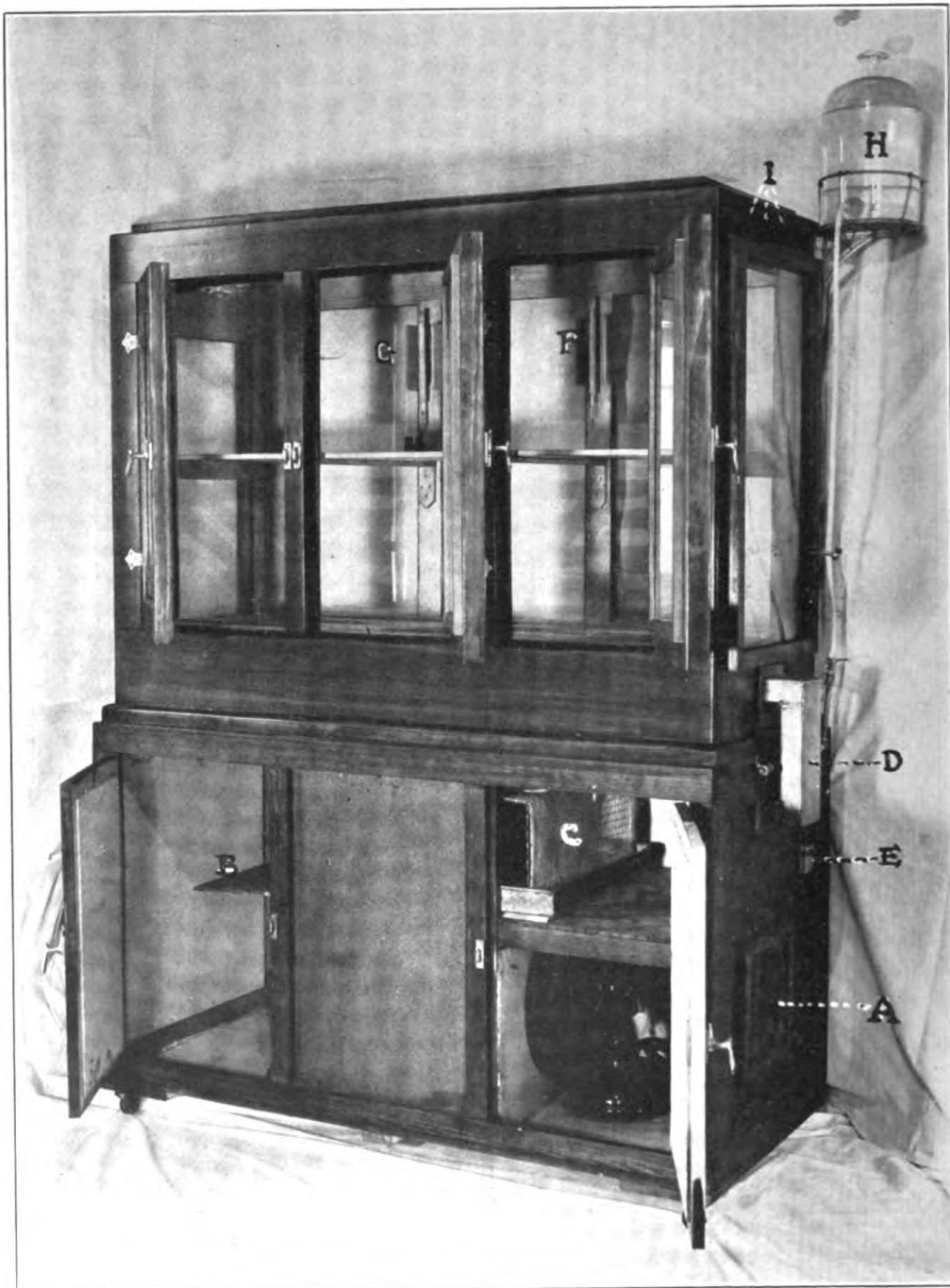


FIGURE 6.—FLY INCUBATOR

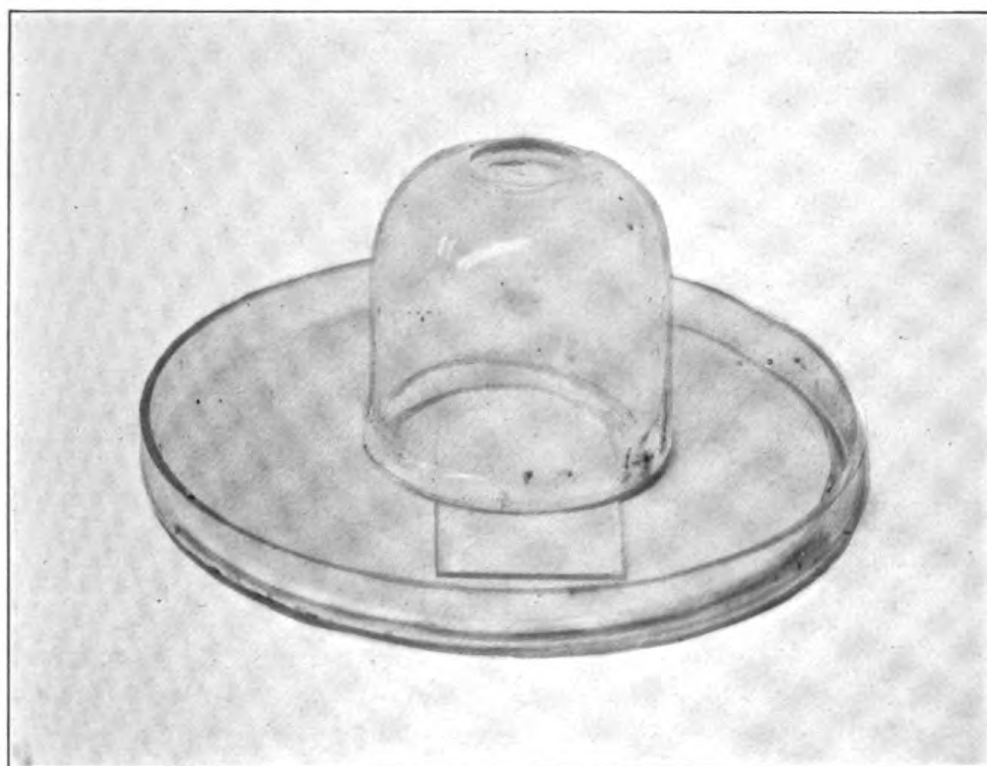


FIGURE 7.—FOUNTAIN TYPE WATER DISH

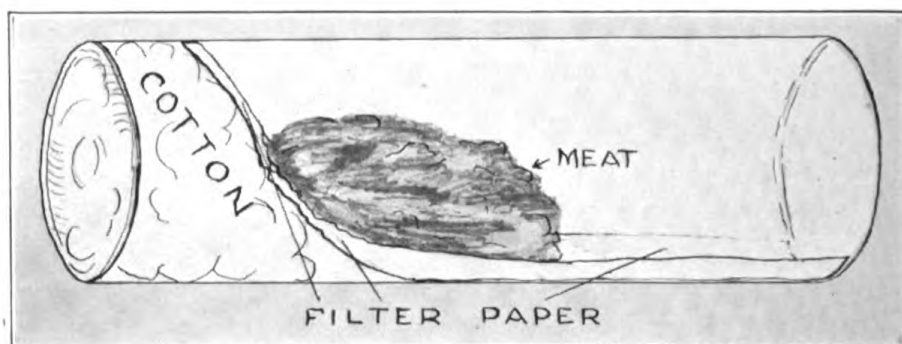


FIGURE 8.—EGG VIAL

(c) *Meat dish*.—This consists of one-half of a petri dish, the bottom of which is covered with six thicknesses of filter paper well soaked with water. A piece of raw pineapple slightly smaller than the filter paper and about 1 centimeter thick is placed in the dish and a piece of meat approximately the same size is laid on the pineapple. Raw pineapple is used because of its proteolytic action on the proteins of the meat. There is doubt as to the ability of the flies to assimilate raw-meat protein. Wild flies under natural conditions prefer flesh undergoing putrefaction, and this use of the pineapple is an attempt to furnish the flies with a similar food in a less objectionable manner. Cooked meat has not been found satisfactory.

The three dishes are made up each morning with clean glassware and new filter paper. They are put into the cage through the small doors and so arranged that the meat and water dishes are in front. Every two hours during the day the meat is turned over on the pineapple so that the moist, digested surface is uppermost and can be eaten by the flies. If at these times the filter paper in the water dish is not saturated the fountain is tipped slightly so that a small amount of water can escape. At 4 p. m. the meat and fruit dishes are removed for the night. The next morning the water dish is taken out and the bottom of the cage cleaned with a long applicator. The three freshly prepared food dishes are then put in place.

Flies lay better when they have plenty of sunlight and air. For this reason our incubator is in front of a window. When the outside temperature permits, the cages are taken out and set before an open window in the direct sunlight for several hours each day. During colder weather the window by the incubator is opened so that some of the ultra violet rays can reach the cages through special glass in the side of the incubator. During hot summer weather the cages should be placed so that at least half the cage is shaded.

Ordinarily flies are not changed from cage to cage. When they cease to produce a sufficient quantity of eggs or it is desired to destroy the flies for any reason the cage is placed in the autoclave for 20 minutes at 10-pounds pressure. The dead flies and gauze cover are then removed and the cage scrubbed. After drying it is recovered and is again ready for use.

Collection of eggs.—Oviposition usually takes place during the evening and early morning hours. The egg vials (fig. 8) are inserted in the cages after the meat and fruit dishes have been removed in the afternoon. A number of spare vials are made up and left near the incubator under a bell glass. The vials in the cages are examined every two hours during the night. Those found to contain eggs are removed and numbered to correspond with the number of the cage from which they were taken. They are immediately placed in the

ice chest so that none of the eggs will hatch before sterilization, for it is useless to try to sterilize a mass of eggs some of which have already hatched. Spare vials are inserted to replace those removed. Egg vials are not used during the day, and occasionally eggs are deposited in the meat dishes. These are collected when the dishes are removed from the cages and placed on wet filter paper in a vial and stored in the ice chest. They are sterilized the following day along with the eggs collected during the night.

Sterilization of eggs.—One can be easily convinced by a brief observation of oviposition that the albuminous material surrounding the eggs is heavily infected throughout the entire cluster. Before sterilization can be accomplished this infected material must be removed and the cluster completely broken apart, for in no other way can the solution used for sterilization be brought in direct contact with the entire surface of each egg. The removal of this albuminous material is the purpose of the first step in the sterilization process.

The clusters are removed from the egg vials by means of a platinum spade, put in a tube one-half filled with water, and left to soak for five minutes. The clusters are then broken up into small masses with the spade, care being taken not to crush the eggs. The tube is stoppered and shaken for a few minutes until the eggs are well separated. Enough Dakin's solution is then added to three-fourths fill the tube (thus making a 1 to 2 dilution). The stopper is again inserted and the tube shaken vigorously for one minute. The eggs will now be found entirely separated and free from the albuminous coating. They sink quickly to the bottom of the tube so that the Dakin's solution can be poured off immediately, and the eggs are washed with several changes of sterile water. The Dakin's solution is made so that it contains 1.6 per cent anhydrous sodium carbonate and 0.39 per cent chlorine.

Many solutions for sterilizing the eggs have been investigated, but all injure the eggs when used in a strength which is effective against the spore bearing bacteria. For this reason we use weaker solutions and increase their efficiency by the addition of a process of mechanical washing. The apparatus (fig. 9) is wrapped and sterilized in the autoclave. Sterility of the inside of all parts is maintained when it is being set up for use. The sterilizing solution is 2,000 cubic centimeters of a 1/1,000 bichloride in 0.5 per cent hydrochloric acid. This is poured into the Erlenmeyer flask A which is stoppered and placed in the rack in an inverted position. The mouth of bulb B is flamed. The eggs are poured in the bulb and stopper C inserted. The bichloride solution is then allowed to run slowly through the apparatus for one-half hour, during which time the eggs are shaken gently. Every few seconds it is necessary to stop the flow of the

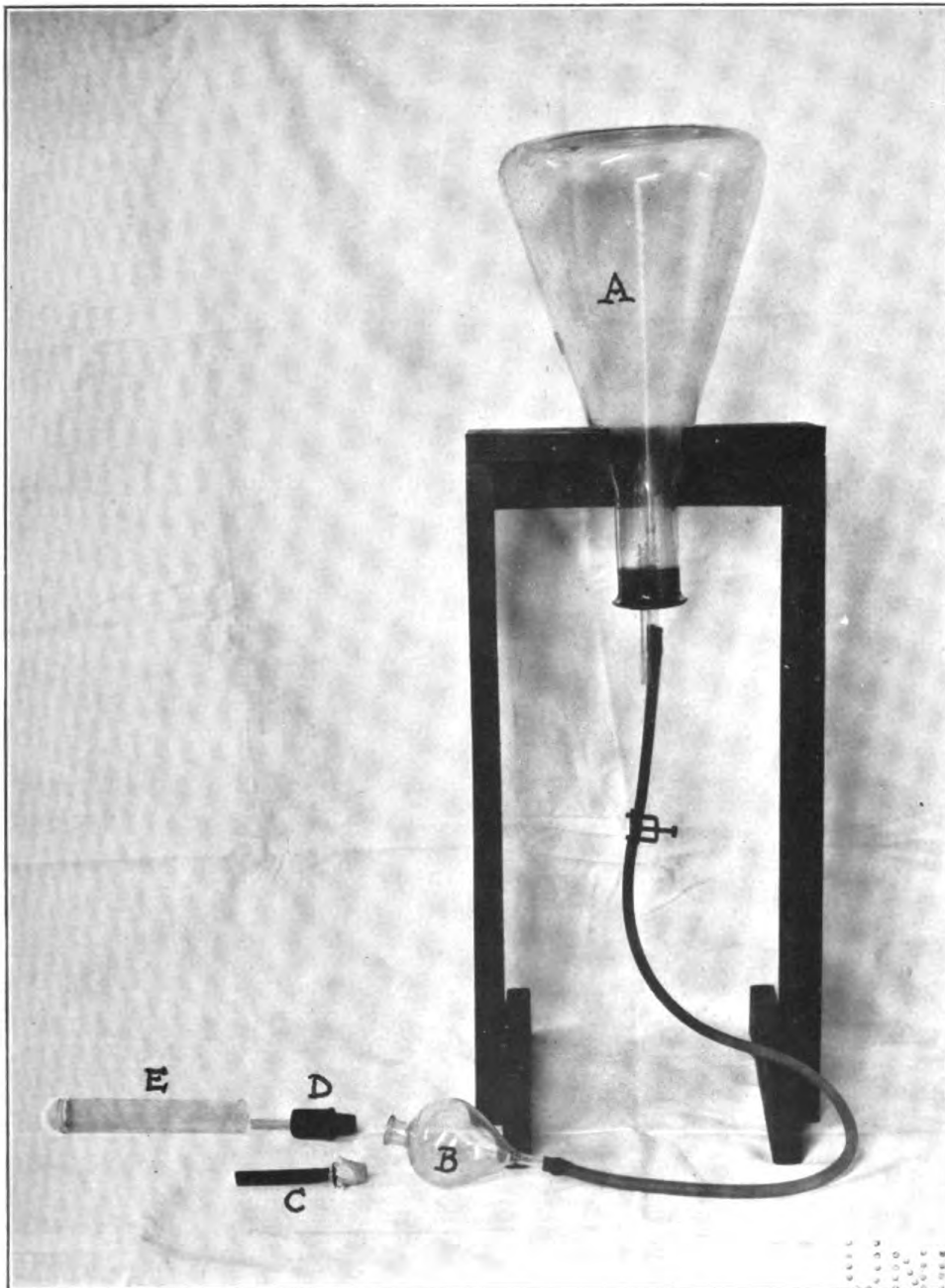


FIGURE 9.—APPARATUS FOR STERILIZING THE EGGS.

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solution for an instant by pinching the rubber tube attached to stopper B, in order to release the eggs collected on the crinoline over the hole in the stopper.

When sterilization has been completed the flow of the bichloride solution is stopped, stopper C is removed and replaced by stopper D in filter tube E (which have remained wrapped until now). The eggs are washed into the filter tube with more bichloride solution. The filter tube is then removed from the apparatus and the bichloride washed off the eggs by pouring a small amount of sterile saline through the tube. When this has drained out, masses of eggs about 0.5 centimeter in diameter are transferred to culture bottles with the customary technique for bacterial transfers. The large quantity of bichloride solution is used to prevent the loss in its strength which might occur through precipitation of the bichloride by albumin from the eggs. The hydrochloric acid aids by increasing the solubility of the bichloride. The constant shaking of the eggs allows the entire surface of each to be acted upon by the sterilizing solution and favors the mechanical washing away of spores.

Growing and culturing sterile larvæ.—After inoculation, the culture bottles are placed in the larvæ incubator. This is preferable to the 37° C. incubator, as many newly hatched larvæ do not survive at this higher temperature. The next day the bottles are put in the 37° incubator for eight hours to favor the growth of any bacteria which may be present. At the end of this incubation, larvæ are removed from each bottle and cultured both aerobically and anaerobically. (These cultures are read at 48 and 72 hours, respectively.) The bottles are replaced in the 37° C. incubator and examined the next morning for possible contamination which might have occurred when the larvæ were removed. By this time the larvæ are of sufficient size for surgical use and are placed in the ice chest in order to retard their growth. If this is not done their feeding period will be so nearly completed when the cultures are read that the larvæ will be of very little use to the surgeon. Larvæ are still useful after having been stowed in the ice chest as long as one week. This procedure permits the laboratory to have a constant supply of larvæ on hand, which is a great advantage, as it assures a regular supply to the surgeon in the varying quantities which he may require.

Removal of larvæ from the culture bottle.—When required by the surgeon, the larvæ are transferred from the culture bottles to a larvæ tube. (Fig. 10.) This transfer is best made in an inoculating booth. All the apparatus should be sterile and a sterile technique followed. We use a 1-liter beaker and a concave copper mesh screen which just fits over the top. On this is placed a piece of washed

crinoline 20 centimeters square. Warm sterile water is poured into a culture bottle, the larvæ loosened with a wooden applicator and poured into the crinoline sieve. Pieces of media are picked out of the sieve or washed through with the aid of more water. The larvæ can then be transferred to the larvæ tube with an ordinary teaspoon. It may be necessary to add water to the bottle several times in order to remove all the larvæ. Larvæ should be used by the surgeon as soon as possible after removal from the culture bottles.

DESCRIPTION OF SPECIAL APPARATUS USED

Special apparatus for this work is not as yet available on the market. That to be described, with the exception of the large fly incubator, may be assembled from pieces of laboratory equipment available in the average laboratory. The large fly incubator is the only costly piece of apparatus and is not essential in warmer climates where the outside temperature does not fall below 15° C. during the day.

*Small cages used to obtain eggs from a single fly (fig. 3).—*These consist of a copper wire mesh cylinder, 6.5 by 13.0 centimeters, with a solid top and a 250 cubic centimeter glass beaker, A. To prepare this cage for use several layers of wet filter paper are placed in the beaker and a small piece of raw meat laid on the paper. The fly is put in the wire mesh cylinder which is then quickly shoved into the beaker, B. The wet filter paper provides moisture for the fly and also prevents drying of the meat and eggs.

*Culture bottle for growing sterile larvæ.—*These bottles are 5.5 by 11.0 centimeters, with a firm cotton stopper which is covered with muslin so that the larvæ can not work their way into the cotton. The medium is 5 per cent nutrient agar with 2 per cent glucose, and a piece of liver large enough to project through the surface of the agar when slanted. The bottles are sterilized at 15 pounds for 20 minutes on two successive days and after the last sterilization are slanted as shown in the figure. It is important that there be a moderate amount of water of condensation in these bottles.

*Larvæ pots.—*These are ordinary flower pots, 12 centimeters in diameter at the top, with 1 centimeter of cement in the bottom in order to seal the hole. They are sterilized each time before use and two-thirds filled with clean sand which has been baked in the hot air oven in order to kill any spores that it might contain. The sand is moistened, the eggs placed on the sand and a piece of raw meat about 6 centimeters square and 2 centimeters in thickness is laid over them. A piece of muslin held in place by a heavy elastic band serves as a cover. The sand may be kept moist by standing the pots in about 3 centimeters of water. When the pots are emptied of

pupæ, they are washed and then soaked for one-half hour in a solution of chlorinated lime in order to diminish the odor of decayed meat which they give off during sterilization.

Exhaust-draft incubator for larvæ (fig. 4).—This incubator is necessary to keep the odor from the larvæ pots out of the laboratory. Its construction is well shown in the figure.

A. Screened holes for air supply.

B. Heating lamps.

C. Thermometer.

D. Exhaust pipe leading out of the laboratory. The outside end of this pipe must be screened or else wild flies, attracted by the odor of meat, will work their way through the pipe into the incubator and lay their eggs on the muslin covers of the larvæ pots. When these hatch the young larvæ can bore through the cover to the meat and in this way mix the strain of larvæ being raised.

E. Thermoregulator adjusted to maintain a temperature of 26° C.

The shelves are perforated to allow a free circulation of air through the incubator. An ordinary electric fan is used for a blower.

Fly cages for breeding stock (fig. 5).—These cages are 30 centimeters square and consist of two parts, the bottom and a removable top section which forms the frame for the gauze cover. Wire screen is unsatisfactory, because the flies very soon break their wings by striking against it.

A. Bottom of a cage, showing screened opening which is necessary for the proper circulation of air through the cage. The two side pieces fit into the top section and have holes for four wire pins which hold the bottom and top sections together. The four narrow pieces of wood and elastic belt are used to hold the bottom edge of the gauze cover snugly against the frame.

B. This is the framework of the top section. It will be noted that the right side of the cage is solid excepting for a circular hole 10 centimeters in diameter. This is to allow putting a hand into the cage when necessary. The doors are 5 centimeters high, and each has a hole for the egg vials. These are closed by cork stoppers when the vials are not in place.

C. Complete cage with gauze cover held in place by thumb tacks and elastic belt. The circular hole in the right side is covered by a piece of cardboard. The doors are open in order to better show the egg vials in place.

Fly incubator (fig. 6).—This incubator is used for the breeding stock and will hold six cages. It is constructed so as to maintain a constant circulation of air about the cages at a temperature of 26° C. and a relative humidity of between 60 and 70. Air enters through the screened opening A, is forced by the fan over the heating lamps, passes upward around the end of the baffle plate at B, thence

through the humidifier C, and into the cage compartment through duct D, which extends the entire length of this compartment and has louverlike openings in the side adjusted so that an equal amount of air is distributed to all parts of the compartment. The air leaves the incubator through screened openings in the ends close to the top I.

E. Thermoregulator.

F. Dry-bulb thermometer.

G. Wet-bulb thermometer.

H. Water reservoir for humidifier.

The shelves are made of narrow slats so as not to interfere with the circulation of air. The panels in the sides, top, and doors of the cage compartment each contain two panes of glass, 3 centimeters apart. In this way dead-air spaces are formed which serve as insulation for the cage compartment.

Fountain-type water dish (fig. 7).—This type dish provides a continuous and adequate supply of water in which the flies can not drown or disable themselves by wetting their wings and body, as they do in open dishes. For this dish we use one-half a petri dish, 9 centimeters in diameter, six layers of round filter paper to fit in the dish, a glass microscopic slide, and a medicine glass. To assemble the dish for use the medicine glass is filled with water and the microscopic slide laid on top of it. The petri dish containing the filter paper is then inverted over the medicine glass. The complete dish can now be turned right side up and just sufficient water will run from the medicine glass to saturate the filter paper. If the glass slide is not used, the rim of the medicine glass rests too tightly against the surface of the filter paper and the fountain does not function properly.

Egg vials used to collect eggs for sterilization (fig. 8).—These are clear glass shell vials, 2.5 by 8.0 centimeters. The bottom is filled with cotton which is covered with a strip of filter paper extending to the open end of the vial. The cotton and paper are saturated with water and a piece of meat added as shown in the diagram. These vials are inserted through the holes in the doors of the cages so that the open end of the vial is flush with the inside of the doors. The moisture in the cotton prevents the eggs from drying, and the vials can be inspected for eggs without removing them from the cages.

Apparatus for sterilizing the eggs (fig. 9).—This apparatus furnishes a continuous flow of sterilizing solution, permits agitation of the eggs during sterilization and drainage of the solution from the eggs when sterilization has been completed, without the possibility of air contamination.

A. Four thousand cubic centimeters Erlenmeyer flask of pyrex glass.

B. Leveling bulb for Van Slyke CO₂ apparatus.

C. Rubber stopper to fit bulb B, perforated by a glass tube on the end of which is a short length of rubber tubing. A single layer of crinoline folded over the small end of the stopper forms a sieve over the hole when the stopper is in place in the bulb.

D. Two rubber stoppers, one to fit bulb B, and the other tube E, A piece of glass tubing passes through both stoppers and holds them together.

E. Filter tube: this is made from a test tube 2.5 by 16.0 centimeters. A hole is blown in the bottom of the test tube over which a piece of crinoline is secured by a small ring of adhesive. This forms a sieve through which solutions can drain from the eggs.

*Tube for delivering the sterile larvæ to the surgeon (fig. 10).—*This is a test tube 2.5 by 16 centimeters without lip. It is wrapped

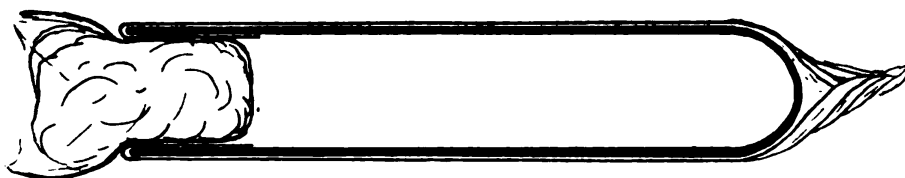


FIGURE 10.—Tube for delivering sterile larvæ to the surgeon

about several times with dark paper which is folded inside the mouth of the tube. A muslin-covered cotton stopper is used. The tube thus prepared is wrapped in muslin and autoclaved. The muslin maintains the sterility of the paper cover around the mouth of the tube until it is to be used so that the larvæ are not contaminated while being transferred. When the surgeon is ready to use the larvæ the paper cover is torn from the lower half of the tube and the sterile end handed him. The assistant then pulls the stopper and remaining part of the paper from the open end of the tube. In this way the entire outside of the tube is sterile when handled by the surgeon.

The authors wish to express their appreciation to Capt. C. S. Butler (M. C.), United States Navy, commanding officer of the United States Naval Medical School; to Dr. D. F. Miller, of Ohio State University; to Mr. F. C. Bishop, of the Bureau of Entomology; and to Elizabeth Elgin, of Doctor Baer's laboratory, for their assistance and many valuable suggestions.

The United States Naval Medical School usually has an excess of sterile larvæ on hand. As these can be forwarded short distances by express, they are available for use at near-by naval hospitals.

REFERENCES

- (1) Kelly, H. A.: A Historical Note Upon Diptera as Carriers of Disease. *Bulletins of the Johns Hopkins Hospital*, 12: 240, 1901.
- (2) Paré, Ambroise: *Apologie, et Traité contenant les Voyages faites en Divers Lieux*, Paris, 1575.

THE WATER SUPPLY OF THE NAVAL ACADEMY

By J. C. PRYOR, Captain, Medical Corps, United States Navy

The United States Naval Academy should have a water supply of unquestioned purity. Such has not been the case until August, 1929. Indeed, the records indicate that the water supply was polluted for about 50 per cent of the time during the two years prior to August 26, 1929. Records of bacterial examinations prior to 1927 have not been consulted, but it is known that the potability of the water was questionable long prior to 1929 and effort had been made to improve the condition. Capt W. H. Bell (M. C.), U. S. N., was especially active in attempting to obtain a pure water supply for the Naval Academy.

History.—The Naval Academy was established at Annapolis in 1845, and from that time until 1866 the records indicate that the water supply of the academy was obtained from cisterns.

On August 24, 1866, a contract was made with the Annapolis Water Co. to supply water to the Naval Academy, and from that date until 1904 all water consumed at the Naval Academy was drawn from the mains of the Annapolis Water Co.

From 1904 to 1910 the Annapolis Water Co. furnished a part of the water supply of the academy, the remainder coming from artesian wells No. 1 and 2, which were drilled at the academy in 1904. Well No. 3 was drilled in 1910; No. 4, in 1912; No. 5, in 1917; No. 6, in 1918; No. 7, in 1925; and No. 8, in 1925.

After 1910 the water supply of the academy was adequate in amount until the increased demand in 1918 and 1919 necessitated augmentation of the supply by purchase of additional water from the Annapolis Water Co.

Since 1919 it has not been necessary to buy water, as the Naval Academy's supply in the fresh-water mains has been adequate. Indeed, it was possible to spare 200,000 gallons daily to supplement the Annapolis Water Co.'s almost exhausted supply during the recent severe drought, as Annapolis was almost without water.

Present condition.—The fire and sewerage systems of the Naval Academy are supplied by water from the Severn River, which is unfit for drinking purposes, as it is salty and polluted by sewage. Water for other purposes is supplied by artesian wells.

Geological data.—The fresh-water supply of the Naval Academy is borne on a stratum (about 600 feet below the surface) which ends in the Patuxent formation. The outcropping of this stratum is along a line roughly marked by Washington, D. C., Annapolis Junction, Md., Baltimore, and Elkton, Md. The nearest approach of this catchment area to the Naval Academy is approximately Annapolis Junction, according to the United States Geological

Survey. Water falling upon this area about 20 miles from the Naval Academy percolates to the above-mentioned impervious stratum and follows it, reaching the Naval Academy at a depth of about 600 feet below the surface.

This water supply has been tapped at the Naval Academy by eight artesian wells, which average about 590 feet in depth. Two of these are not now in service. The water rises in the wells to a level a very few feet below the surface and is forced to the surface by air pressure, the air entering 50 feet below the surface. The water thus obtained is found to contain considerable basic iron, which renders it objectionable, especially for laundry purposes, hence chemical treatment must be resorted to in order to remove the iron salts and condition the water for general use.

Chemical treatment.—In this process of conditioning the water from the artesian well head A in the accompanying illustration flows by gravity into a weir box B, where a tipping meter adds a lime solution to precipitate the iron. This requires about four-tenths of a pound of lime per 1,000 gallons of water treated.

The water next flows into settling tanks C, where the precipitated iron settles out.

From the settling tanks the water is pumped through rapid sand filters D to remove any material still in suspension.

The water next is softened by passing through a zeolite in the softening tanks E. "Zeolites have the property of exchanging the sodium base which they contain for other bases brought in contact with them. They exist naturally in the soils, where they play the important rôle of holding potassium and other alkaline bases in the soil, thus preventing their being washed away with the rain water." (Rosenau.)

Synthetic exchange silicates, or "zeolites," are produced by fusing feldspar, soda, kaolin, and pearl ash. The resulting glass is thoroughly crushed and washed to remove soluble silicates, after which it may be used as a zeolite.

A zeolite of this character is in use at the Naval Academy, and after passing 225,000 gallons of water through it, a 10 per cent solution of sodium chloride is passed through the zeolite, to rejuvenate it.

Having passed through the zeolite, the conditioned water is of excellent quality, and bacterial tests at various steps have shown it to be almost sterile up to this point.

Just here the water is run into six subterranean concrete reservoirs, F, 100 feet long, 50 feet wide, 11 feet 3 inches deep, and connected in series. The top of each of these tanks lies $2\frac{1}{2}$ feet below the surface of the ground, as do the tops of the two settling tanks, which have the same dimensions as the reservoir chambers.

When I reported for duty at the Naval Academy it was soon discovered that water at various outlets was badly polluted.

The "presumptive test" showed gas in all five tubes (or less), each of which was inoculated with a 10 c. c. quantity of the sample, and the "confirmatory test" was positive for *B. coli*.

Further bacterial tests confirmed previous findings that the water is almost free from bacteria—practically sterile—from the time it leaves its 600-foot depth below the surface until it flows into the reservoirs for storage.

The conclusion was ineluctable that nature was yielding pure water which was being conditioned and placed in the reservoirs for storage prior to distribution, and that the water was being polluted while in storage.

It was evident that the underground tanks, which go to a depth of about 15 feet below the surface, are cracked, or that the porous concrete is permitting the entrance of ground water whenever there is a negative pressure in the tanks.

Practically, the reservoirs are constantly either partially or wholly immersed in ground water, as they are close to the level of the Severn River. Obviously, the ground-water table rises with the occurrence of heavy rains, and wherever a negative water pressure exists inside the tanks the ground water makes its way into the tanks, either through the porous concrete or through cracks in the walls.

Reservoirs.—The storage reservoirs lie underground about 300 feet from the Hanover Street boundary of the Naval Academy grounds, and just across Hanover Street lies a thickly inhabited area of Annapolis. Storm water makes its way from this area over and through the ground containing the reservoirs as it seeks its level in the Severn River, which is only 750 feet away.

Obviously, the ground wash from an inhabited city is not a desirable medium in which to submerge porous or leaky reservoirs for drinking water. The pure artesian water should be stored in closed tanks above ground, if practicable, to avoid pollution and the subsequent necessary chlorination. Congressional appropriation would be required for a project of this magnitude.

At the time when this pollution was so manifest an epidemic of 31 cases of typhoid fever was in progress among the population of Eastport. This town, just across Spa Creek, lies at its nearest point only about 1,200 feet from the Naval Academy Reservation.

Two civilians employed in the office of the Superintendent of the Naval Academy, but resident in Eastport, were gravely ill with the disease. It was promptly recommended that all water used for drinking purposes at the Naval Academy be boiled until a chlorinator

could be installed on the service main between the reservoir and the distribution manifold. (For convenience the term "reservoir" includes the six storage tanks which are connected in series.)

The installation of a chlorinator as recommended was found feasible and was ordered by the superintendent of the academy. This installation, "G," was put in operation on August 26, 1929, and immediate improvement occurred.

Associate Prof. J. C. Gray, bacteriologist, of the Naval Academy, in his summary of bacterial tests on water used at the academy for the year ending June 30, 1930, says:

A chlorinator was put in operation on the yard supply August 26, 1929. Before this date the water was repeatedly showing gas in from 3 to 5 tubes, but after 2 weeks of operation no gas was formed in the tubes. Since the middle of September, 1929, no gas has been formed in the lactose broth tubes, except after heavy rains October 2, 1929, and April 6, 1930. The agar counts have also been decreased by chlorination.

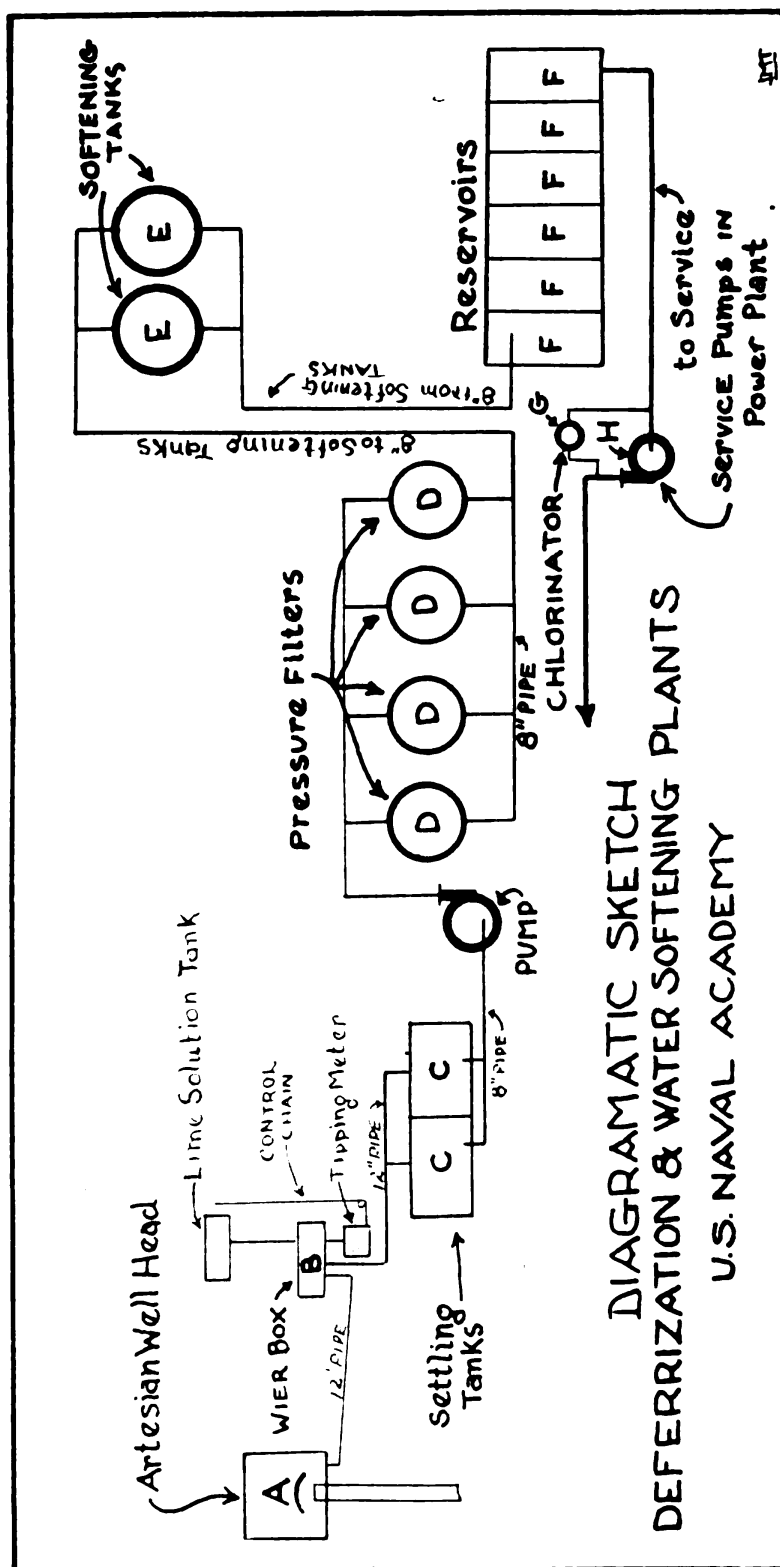
B. coli has not been confirmed since August, 1929.

Chemical analyses.—The average chemical analyses of the water as it comes from the wells and as it is found after treatment and delivery by the service pumps, "H," to the various outlets are shown in parts per million, as follows, by Prof. Gray:

	Raw water	Water from mains after treatment
Total solids.....	115	125
Mineral matter.....	85	85
Alkalinity as CaCO ₃	27	40
Iron.....	16	0.3
Hardness as CaCO ₃	70	4
pH.....	6.3	8.2
Sulphates as Na ₂ SO ₄		60
Chlorides as Cl.....		6
Dissolved oxygen.....		5
Nitrites. Not reported.		
Nitrates. Not reported.		

Comment.—The recommendation of the Medical Department has been fully justified, as indicated by the foregoing quotation from an earnest worker in another department who has performed the laboratory work upon specimens collected by the Medical Department. Bacterial tests are made weekly in winter and biweekly in summer.

During the recent drought, when the many water bottles were being brought daily by officers, enlisted men, and civilians as well, to the academy to be filled with drinking water, and the 200,000 gallons a day were being pumped into the Annapolis city mains, it has been a source of great satisfaction to know that the supply is worthy of confidence.



Conclusion.—From the foregoing it is noted that—

(a) The artesian-water supply of the Naval Academy is practically bacteria free as it comes from the wells.

(b) Its content of iron and hardness is removed.

(c) The water has been seriously polluted in the subterranean reservoirs.

(d) Installation of a chlorinator on the service main as it leaves the reservoirs has given excellent results as gaged by standard methods of examination.

(e) The fire and sewerage systems are supplied by salt water from the Severn River.

ANESTHESIA—THE MINIMUM REQUIREMENTS FOR NAVY NEEDS¹

By A. H. DEARING, Lieutenant Commander, Medical Corps, United States Navy

The mere fact that there are many different forms of anesthesia and that new anesthetics and methods are being continually sought demonstrates that the ideal anesthetic has not yet been found. However, improvements in anesthetics are constantly going on and it behooves us in the Navy to keep in touch with these improvements and attempt to select those methods which are best suited to our needs. An anesthetic which proves nearly ideal in a large metropolitan hospital with fixed staff, a highly trained and expert anesthetist, and practically fixed operating room personnel may be entirely unsatisfactory for routine use in a naval hospital with shifting personnel. An anesthetic which may be routinely used by the surgical staff of a naval hospital may be entirely unsuited for use aboard ship by the medical officer who occasionally operates and then only in emergency, perhaps, with the handicap of partially trained assistants. Methods requiring elaborate apparatus and careful preoperative and postoperative care may be impossible of application under war-time conditions such as may exist in a mobile field hospital with landing or expeditionary forces. Yet any of these conditions may confront the naval medical officer. He must be prepared to do emergency surgery; he may be called upon to do more than this. His inclinations and talents may lead him far from the surgical field but he must be prepared for emergencies when he is alone.

It would be ideal for each medical officer to be trained in every method of anesthesia. This is obviously impossible, as it is impossible to expect each medical officer to be, for example, skilled in avia-

¹ Read at the weekly conference of the Washington Naval Hospital and Naval Medical School, January 16, 1931.

tion medicine or in pathology, etc. Unless he has devoted considerable time and study to surgery, he can not become expert or even skilled in many methods of anesthesia. However, each medical officer can and should train himself in some basic method or methods of anesthesia. As he goes on in his career he may broaden this knowledge as opportunities for training avail. He may eventually have many methods at his command or he may never have but the one, but that one should be one which will stand the test of all Navy conditions.

The principal accepted anesthetics available and in use to-day are listed below:

A. Inhalants:

1. Ether.
2. Chloroform and ethyl chloride.
3. Nitrous oxide.
4. Ethylene.

B. Local anesthetics:

1. Cocaine for topical application.
2. Procain (novocaine).
 - (a) Local infiltration (including its use in fractures).
 - (b) Regional block anesthesia—
 - Field block.
 - Nerve block—
 - Paravertebral and splanchnic.
 - Transsacral and plexus block.
 - Caudal or epidural.
 - Spinal anesthesia.

C. Barbituric acid derivatives—sodium amytal.

D. Avertin—Tribromethanol.

In our hospitals, and in fact at all stations where feasible, the surgeon should ideally have all or nearly all of these anesthetics at his command. He may then select therefrom the method or methods best suited to each individual patient whose interests and needs must ever be kept uppermost. But which of these methods will most nearly fulfill the requirements of the basic minimum anesthetic needs of the Navy?

Before considering the anesthetics let us list the fundamental requirements or characteristics of such a basic minimum anesthetic foundation to meet Navy needs—under all Navy conditions—in peace or in war. These seem to be:

1. *Safety*.—The interests of the patient are paramount and safety is his greatest demand.
2. *Efficiency*.—The method must produce an efficient anesthesia of sufficient depth and length to permit of the operation.
3. *Simplicity of application*.—It should not require elaborate or complicated apparatus.

4. *Controllability*.—It should permit of administration or application by the surgeon himself or at least by relatively untrained personnel under his direction and supervision.

5. It should be a method easily and quickly learned. The lack of opportunity and time for training and lack of constant use do not permit of methods which require long study and training and continued practice.

6. Commercial availability in time of war must be considered.

Let us briefly review each of these methods and consider them in relation to the above requirements.

Of the inhalants, ether is probably still the most widely used. It is the safest of the inhalants because of the wide margin of safety in its administration. It is an efficient anesthetic, as demonstrated by decades of use. It requires no apparatus except a folded towel or piece of gauze and the ether itself. Elaborate masks, drop bottles, and closed bags have been fashioned, but they are not essential. It may safely be placed in untrained hands if they are those of an intelligent person who will carry out the directions of the surgeon. It is a method easily learned. Once mastered, its application is an art that is never entirely lost, regardless of lack of practice. It is available at all times and at almost every naval activity where there are medical supplies.

Chloroform and ethyl chloride are efficient inhalation anesthetics. Their margin of safety is much narrower than ether. They should ordinarily be used only by one experienced in their administration. In the Navy their use is nearly nil. Of the 2,851 operations on Navy personnel listed in the Surgeon General's report for the calendar year 1929, chloroform was used but 14 times and 11 of those were for paracentesis of the eardrum.

Nitrous oxide with oxygen, and ethylene-oxygen, either with or without ether sequence, are probably the inhalation anesthetics most agreeable to the patient. They are the general anesthetics of choice in hospitals when inhalation anesthesia is desired. Their factor of safety is less than ether under the same conditions. However, they require an anesthetic apparatus of considerable complicity and bulk. Their safe and efficient administration is a specialty in itself and should only be attempted by one properly and thoroughly trained and with ample experience. Ethylene requires rather elaborate safeguards to prevent explosion. It seems to me that these factors eliminate them for routine use at sea.

Cocaine and its topical application has a rather limited use in emergency and general surgery. It requires no further discussion.

Procaine or novacaine, using the terms interchangeably, offers us an anesthetic agent which is of great value and wide application. It is a safe anesthetic agent. The limit of tolerance for the drug is high, permitting the use of sufficient quantities of solution. Properly

administered it produces an efficient anesthesia. Let us review the methods of use before considering procaine in relation to our criteria.

Local infiltration consists simply of completely infiltrating the site of operation with procaine solution. This method is easily and quickly learned and has a considerable field of application. Under this heading we may place the use of local anesthesia in treating fractures by injecting procaine solution at the site of fracture. The technic of its application is so simple that it may be easily mastered. The anesthesia is so efficient in recent fractures that when first used one is surprised that such a simple procedure can be so effective and so valuable. The method consists simply of passing a sterile needle on a syringe filled with sterile procaine solution to the hematoma at the site of fracture, under strict aseptic precautions. When the hematoma is reached, as demonstrated by the ability to aspirate blood into the syringe, from 20 to 30 cubic centimeters of 2 per cent procaine are injected into the hematoma and the needle withdrawn. Usually within five minutes the patient is free from pain, and, with freedom from pain, muscle spasm ceases. The fracture may then be painlessly manipulated and splints applied in any desired position. The only precaution is to be certain of the aseptic technique and the skin sterilization to avoid infecting the hematoma and the fracture.

Regional anesthesia is safe. Its efficiency varies with the skill and training of the operator. Field block consists of placing a wall of solution infiltrated in the tissues about the site of operation, thus cutting off all painful stimuli which may be initiated there. This method is a bit more complicated than local infiltration and is not applicable in many cases. It is of considerable value in blocking off extremities such as hand, fingers, toes, etc.

Nerve block consists of placing procaine solution either in, or in close contact to, all the nerve trunks which conduct painful stimuli from the field of operation. This may be done as they emerge from the spinal foramina (paravertebral) through the sacral foramina (transsacral). or at plexus (brachial plexus and cervical plexus block) or by caudal anesthesia. In caudal anesthesia the lower sacral and coccygeal nerves are blocked in the sacral canal by the injection of procaine solution through the sacral hiatus. With the exception of caudal anesthesia, nerve blocking demands considerable training and study and constant practice to give efficient results. It requires a thorough knowledge of anatomy and easy familiarity with anatomical landmarks used almost only for this method. Caudal anesthesia is easily done, is relatively safe, and does not require intensive training nor long and constant practice. It is a very valuable method of anesthesia for anorectal surgery.

Spinal anesthesia consists of blocking the nerve roots as they enter the spinal cord. The anesthetic solution is injected subdurally into

the spinal canal, where it bathes the roots and the cord. This method produces the most efficient anesthesia over the largest area of any method of nerve blocking. It is applicable for any operation below the diaphragm with a high degree of safety. It has been used in thousands of cases and is being increasingly used throughout the country and the Navy. The work of Babcock, Labat, Pitkin, and others in this country has added greatly to the knowledge of the physiology of spinal anesthesia. With this knowledge its use is increased and its dangers almost entirely eliminated. The method described by Labat has proved most efficient in our hands and is the easiest and simplest.

Let us now consider the use of novocaine in its various forms of application in relation to our criteria for a basic minimum anesthetic to meet Navy needs.

Safety.—There is no argument about the safety of infiltration and regional anesthesia. Spinal anesthesia has to-day reached the stage of development where its use by properly trained individuals is as safe as any anesthetic we have.

Efficiency.—The efficiency of each method varies with the nicety of its application, and this in turn depends on the training of the individual surgeon. Again we have the question of training. Each method will produce a 100 per cent efficient anesthesia if properly applied. It is agreed by all authorities that spinal anesthesia provides the most efficient anesthesia known for abdominal surgery, and a knowledge of its technique is considered by some an essential in certain abdominal cases.

Simplicity.—No complicated apparatus is needed. The armamentarium is of the simplest—a Luer syringe, needles of varying lengths and gages, spinal needle, and procaine. All are on the supply table of the Medical Department. Ampules of sterile novocaine crystals in measured quantity for spinal anesthesia are easily obtained, keep indefinitely, and are inexpensive.

Controllability.—The surgeon is his own anesthetist, entirely independent of trained assistants.

Ease of learning.—As we have seen, training and ability to use these methods govern both their safety and their efficiency. Local infiltration technique is easily acquired in a short time. Caudal anesthesia may be quickly and easily mastered.

Regional block requires a longer period of training, an excellent knowledge of anatomy, and constant practice to guarantee satisfactory and efficient anesthesia. We do not feel that in the time usually available for training in anesthesia the average individual can acquire sufficient ability in the art of regional block to allow of his depending on it, alone, for the occasional major emergency opera-

tion. It will, however, be valuable to him in surgery on the extremities and in traumatic surgery in the form of field block.

The mechanics of administering spinal anesthesia are simple and are easily and quickly mastered. Any medical officer who conscientiously wishes to do so may quickly learn the physiology and broad principles of this method. He may easily learn the simple technic laid down by Professor Labat. With this knowledge and the increasing experience of use he will find himself possessed of a method of anesthesia, easily and safely applied, which will be a boon to his patients and himself and which will prove invaluable on many occasions.

Let us consider the other two methods on our list. Sodium amytal was first described in 1923. It is like all of the barbituric acid derivatives—a hypnotic and narcotic. There are two distinct fields of use: (1) As a complete anesthesia. The drug is administered intravenously, usually in 10 per cent solution according to established technique, with the hope and expectation that it may serve as the only anesthetic required for the operation. Many of these cases require the use of another anesthetic to complete the operation. The Mayo clinic during the year ending April 1, 1930, reports its use in 753 cases. Of these, 475, or over 50 per cent, required another anesthetic to complete the operation. Its use as a complete anesthetic by the intravenous route is acknowledged by even its most enthusiastic supporters to be still in the experimental stage. (2) The second use is as a basal anesthetic, administered in smaller doses by vein, by mouth, or rectally. By this method the patient is rendered somnolent, or nearly so, prior to the use of an additional anesthesia either with an inhalant or by procaine by some of the methods listed.

Avertin, or tribromethanol, was first described and used in 1925 in Germany. Since then it has had wide application in Europe and has been used in many thousands of cases in this country. The drug in measured dose according to body weight is dissolved in distilled water at 40° C. and instilled into the rectum. Absorption is rapid, and the patient is usually asleep within 10 minutes of its administration. We have had no experience with this anesthetic, but nearly all American writers agree that in a large percentage of cases a supplementary anesthetic is necessary to produce sufficient relaxation and anesthesia to carry out any but relatively minor operative procedures. By increasing the dosage deeper anesthesia may be obtained, but to obtain this stage it is necessary to approach too closely a dangerous dosage of the drug. In practically all of the published reports we have found in the literature avertin is considered only as a basal anesthetic to be supplemented by other methods to obtain full surgical anesthesia.

Let us consider both of these in relation to our criteria.

Safety.—Sodium amytal is acknowledged to be in the experimental stage as a complete anesthetic. Nearly all writers agree that sufficient dosage of avertin to produce complete anesthesia approaches too nearly the danger point of this drug. Once instilled in the rectum and absorbed, as it quickly is, it can not be recalled. There is no warning sign and no established antidote if the dose has been either inadvertently or mistakenly made too large.

Efficiency.—They do not produce efficient anesthesia safely even in the hands of those most experienced in their use. Dr. Joseph Guttman, of Chicago, who first introduced avertin in the United States, and who has had wide experience with it, states that 20 per cent of his cases require a supplementary anesthesia in addition to avertin to obtain complete surgical anesthesia. The manufacturers of both of these drugs refer to them as basal anesthetics only.

Simplicity of application.—They are simply applied prior to operation, but the postoperative care may be complicated. If sufficient dosage of either drug is used to attempt complete anesthesia, they may produce a long period of postoperative sleep, during which a special nurse is required. The patient may have so much relaxation of his jaw that he must be constantly watched to prevent asphyxia. His position must be changed frequently during this sleep to prevent pulmonary complications.

Controllability.—The technique of their administration is easily mastered, but the disadvantages seem to outweigh this consideration.

Availability.—Neither of these drugs has as yet been accepted by the United States Pharmacopœia. They are not universally nor even commonly accepted anesthetic agents. Probably few ships have them in their supplies. Avertin at the present time is manufactured only under foreign patents and in time of war the supply might be very limited.

Amytal and avertin are both valuable adjuvant or basal anesthetics. They are not at the present time safe, complete anesthetics on which dependency may be placed for full surgical anesthesia. They are of most value to the operator who has other methods of anesthesia at his command. They should be carefully used when indicated in naval hospitals in an endeavor to maintain a knowledge of their value, especially in cases where anteoperative nervousness or apprehension is a large factor.

Of these methods, which most nearly fulfill the requirements of a basic minimum anesthetic for Navy needs? What method or methods can be easily and rapidly mastered by each medical officer, require least material, are safe and efficient under all conditions of use? It seems to us that novocaine and ether most nearly fulfill

all requirements. Novocaine may be used as the training and experience of the individual best permits, plus open-drop ether to reinforce or replace the novocaine in those cases where the local anesthesia is ineffective or where the individual doctor feels that a general anesthesia is indicated.

The usual emergencies which require operation in the service can, we believe, be met efficiently and safely with this minimum equipment and training; injection of the hematoma in fresh fractures, caudal anesthesia for work about the anus and perineum, spinal anesthesia for acute abdominal conditions, or major trauma of the abdomen or lower extremities; local infiltration or regional block for empyema, for lacerated wounds, or other trauma; open-drop ether wherever for any reason novocaine anesthesia is not indicated or can not be used.

Type of anesthesia used at Washington Naval Hospital—percentage for each year

	1928	1929	1930
Operations.....	350	549	606
General.....per cent..	30.5	32	22.7
Local.....do.	54.3	61.6	47.5
Caudal.....do.	15.2	6.4	17.9
Spinal.....do.	0	0	10.9

BIBLIOGRAPHY

- (1) Annual Report of the Surgeon General, United States Navy, 1930.
- (2) Lundy, John S.: Intravenous Anesthesia Current Researches in Anesthesia and Analgesia. Vol. IX, No. 5, pp. 210-217.
- (3) Labat, Gaston: The Trend of Subarachnoid block. Surgical Clinics of North America, June, 1930.
- (4) Pitkins, G. P.: Controllable Spinal Anesthesia. American Journal of Surgery 5: 537, 1928.
- (5) Babcock, W. W.: Textbook of Surgery.
- (6) Korter, H., and Kasman, L. P.: Spinal Anesthesia for the Head, Neck, and Thorax, Its Relation to Respiratory Paralysis. Surgery, Gynecology, and Obstetrics, November, 1929, pp. 617-630.
- (7) White, C. S., and Kreselman, J.: Tribromethyl Alcohol (Avertin) Anesthesia. Surgery, Gynecology, and Obstetrics, September, 1930, 361-365.
- (8) Guttman, J. R.: Rectal Anesthesia with Tribromethyl Alcohol. American Journal of Surgery, July, 1930, pp. 70-72.

MEDICAL LITERATURE¹

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The style changes that have been taking place in medical literature during the present century are as distinct and extensive as

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those that have been occurring in fiction or in political speeches or, to use a comparison not nearly so far-fetched as it might seem, in the fashions of clothes.

Most, if indeed not all, of these changes have been in the direction of improvement. In large part they have been simply a natural accompaniment to the great scientific advances of the times, but quite independent of this scientific progress, many of them have followed the rising fashion for simplicity of expression and utility of purpose.

If we examine a medical periodical of 30 or more years ago we shall find that most of the articles did violence to the present conventions that have grown out of our realization for the need of purging the literature of the faults that once filled it. If one wishes to be guided and warned about the features that must be avoided he may look through some of these earlier periodicals. The experience should serve him well. He will be amused by some of the articles; others may so infuriate or disgust him that he will resolve for all time to never touch pencil to paper except with the determination to steer clear of the crimes that spotted those articles.

What was there about those articles that would make them so objectionable to-day? To state the matter briefly, they contained more rhetoric than medicine. They were full of speculation and opinion, expressed in elaborate language which often called into use poetic and biblical and other classical quotations. Only rarely did they record thoughts that had been formed with the assistance of the long and cold and toilsome observations of laboratory and clinic that stand behind most of the present-day productions. They were often very personal and very intemperate; but their chief fault was their wordiness—a prodigality of words that fitted poorly their paucity of useful and lasting ideas.

If the medical writer of to-day fails to avoid these obnoxious elements the result will be an article which is as ludicrous and irritating and out of date as Victorian fiction or the political tirades we heard in the days of torchlight parades, or a woman's hat weighed down with bird appendages and assorted artificial fruits and flowers.

It is far from my intention to maintain that no good medical literature was produced prior to the year 1900, for the fact is that this generation has probably produced no medical classics to equal the best medical writings of past centuries. But it is held that the bulk of medical writing to-day is quite good, whereas the bulk of earlier medical literature was quite bad.

An article to-day ought to be in the strictest sense a contribution. It must announce some discovery that will aid in the practice of medicine or in our understanding of a medical problem; or it

must report the results of a wide experience with some recently introduced procedure, an experience so wide or intensive that the author's evaluation can be taken as representing the true worth of the method.

Articles that do not meet these requirements, but still are worth the cost of printing or the time of reading are extremely few. For example, the form of essay used for presidential addresses at annual conventions may tell us nothing new, but these essays usually contain the thoughts of eminent, keen-minded men, and, being very informing surveys of present trends and future expectations, except when they are devoted, as they unfortunately sometimes are, to medico-political matters, they make very fine reading. Notable recent examples of the highest type of these essays are Martin Rehfuss's 1930 oration in medicine before the Illinois Medical Society (Real Problems of Modern Medicine) and Reid Hunt's presidential address before the 1930 United States Pharmacopœial Convention (Promotion of Medicine and Pharmacy).

The historical articles and books, being the most difficult to write in a form which will justify their existence, are rarely found acceptable by editor or publisher and rarely manage to find a sizable audience. Unless they are written by the inimitable Garrison or others of such fine historical sense and philosophy and high literary skill as Dana or Packard or Crummer or Krumbhaar or Warthin or Cushing, they may come dangerously close to supporting Henry Ford's well-known opinion of history.

Case reports should have primarily a large teaching value and should include only such elements as are pertinent to the lesson. They might present nice solutions of knotty problems in diagnosis or they might teach the value of different methods of treatment or open a more accurate view on the prognosis of some disease, but their content must be entirely directed to the end of teaching. No purpose is served in reporting a case of some common condition that follows the common course or presents no problems. Such a case lacks what the journalists call news value. To illustrate, a newspaper would not bother to report an encounter between a man and dog in which the dog bit the man. But if the man bit the dog the case report would reveal a new and interesting possibility in human behavior.

In relating case histories or in recounting one's experiences with some new technic or method of treatment it is well to keep the article as impersonal as possible. The passive voice and other devices for avoiding the first person are much less wearisome to the reader and are much less apt to arouse his suspicions of the writer's vanity or motive of propaganda.

Nearly all medical articles to-day are in some measure reports of research. From the purest and frankest form of research down to some simple experience the record contains observations and interpretations that have led the author to conclusions which he hopes may contribute new light, no matter how small the ray, to some problem of medicine.

And if it contains an element of research, the article must be, above everything else, conservative. No conclusion should be stated unreservedly unless the article has clearly brought out sufficient evidence to place that conclusion in an incontrovertible position. The language must be as precise as the work is supposed to have been. Looseness of language can only suggest that the work itself was inexact. The word "cure" is one of the most frequent offenders against conservatism of thought and precision of language. Being a transitive verb (except when used as a noun), it denotes the agent under discussion as being responsible for the patient's recovery. It moreover implies that the particular agent was the sole agent and that the recovery was permanent. Its use is sometimes permissible in discussing certain surgical results, for example, the permanent cure produced by a hernia operation, but it is not often justified in other fields. In most instances it would be more fitting to use such expressions as "recovery" or "apparent cure" or "apparent recovery" or "symptomatic recovery" or "the disappearance of (certain) lesions." In syphilis, for example, we could rarely (if ever) use the word "cure," nor could we speak of "disappearance of lesions" except some certain observable lesion, as chancre or skin ulcer.

Next to conservatism and precision, clarity is demanded. One may be conservative in his claims or deductions and precise in his terms; yet his sentences may be so constructed as to leave much doubt as to his meaning. To achieve clarity, revision after revision may be necessary, and each improvement will usually follow a shortening rather than a lengthening of the article. The long sentences will be chopped into shorter ones, and these together will total fewer words than the original long sentence. Verbiage is detestable enough anywhere, but it constitutes a high crime in scientific literature. It befogs the thought, tries the reader's patience and lowers his interest, and gives the writing a pedantic, not to say assinine appearance. Superfluous syllables may even be as harmful as superfluous words. Short words in common usage make for clarity and force and are always to be preferred to the longer or less used words except where these latter very definitely express the thought more precisely. To illustrate, there is no point in using such a word as "termination" if the word "end" expresses the thought just as well.

Brevity, besides being the soul of wit, is the heart and soul of good medical writing. By this I do not mean brevity at the sacrifice of

essential points of the thesis but rather at the sacrifice of rhetorical decorations. Medical writing is no place to "say it with flowers"—say it with plain words, good straightforward English words (if you are writing in English—Latin words and expressions will look more at home if the whole article is in Latin) and say it with the fewest possible words that can be used without making it look like a telegram. Last year a certain article appeared which attracted wide and favorable comment. In its original form the manuscript covered 60 pages without margin. In that form it was not only unpublishable, it was unreadable save at the loss of the reader's temper, not to say his mind. Many of the ideas it expressed were extremely sound and were very interesting and important, but most of them were expressed each about a dozen times during the course of the article. Because of the valuable information it contained, the article was saved and put through an editorial process, from which it emerged on 20 pages of manuscript with wide margin and without the omission of a single thought that had been expressed in its original form. Result—a nicely finished job, for which the author received much credit and the editor perhaps some condemnation from the author, who recognized in the article nothing of his own production except the thought and the signature.

An article may be conservative, sincere, clear, precisely and simply worded, and may impart new and valuable knowledge, but with all these virtues its worth as a piece of writing may be seriously lowered by poor organization. If the writer does not start at the beginning and end at the ending, the reader will find himself quite in the position of a person arriving at a movie at the middle of the picture. Since the title must be short, it can only convey a general idea of the article's nature, and unless the opening sentences give a more specific clue to the thesis one may not discover until he nears the end whether the article contained the sort of information he hoped to find in it. Unlike the mystery story, the whole plot must be revealed quickly and neatly at the very beginning. The historical background is often helpful, if short enough, and a short resumé of the observations of others may give the reader a very desirable perspective of the matter under discussion. The paragraphs must follow each other in perfectly logical sequence, and tables, figures, etc., must appear at exactly the proper spots. If the tables are very numerous, covering more space than the article itself, they may appear together at the end of the article.

Above all, a summary should really summarize, and if there are conclusions of which the writer may be certain they must appear and they must be worded with ten times the care given to the wording of the rest of the article. There are several reasons for this, one being that the conclusions are habitually the only part of articles

read by many a busy reader, and another being that the whole scientific value of an article is wrapped in the conclusions.

In writing on controversial subjects, let there be no heat. Bitterness must be avoided not only because it has fallen out of fashion but because its display destroys much of the force and real conviction of the argument. There is nothing more admirable than the statement of one side of a controversy in temperate language. Very unlike the pleading of a case in the criminal or divorce court, one must here remain impersonal and dispassionate. In former times, he that called his brother a fool was only "in danger of hell fire"—now he stands in danger of more immediate consequences, such as that of appearing quite foolish himself. Acrimony was quite all right in its day, but its day in medical literature has passed, just as duelling has passed. Those who have read of the terrific controversies that raged in the day of Benjamin Rush, especially those that arose during the Philadelphia yellow fever epidemic of 1793, will appreciate how far we have progressed in scientific courtesy since colonial times.

I have dealt in generalities and have purposely avoided any discussion of the many technicalities that enter into medical writing. This phase of the subject is very ably handled in a few standard works, the latest of which is the third edition of Mrs. Mellish-Wilson's *The Writing of Medical Papers*. Another guide of high value is the pamphlet published by the American Medical Association. This pamphlet combines the 10 articles by C. H. Simmons and Morris Fishbein that appeared in the *Journal of the American Medical Association* in 1925. Another is the well-known *Notes on the Composition of Scientific Papers* written by Sir Clifford Allbutt in 1923.

In addition to a study of these technical works, one can examine certain models of the finest medical writing. For descriptive English as applied to medical subjects, excellent models are furnished in the writings of Osler, Oliver Wendell Holmes, Weir Mitchell, John Hunter, Sir James Paget, Sir James Mackenzie, Sir Jonathan Hutchinson, and perhaps a dozen others. For logical reasoning combined with almost all the other virtues of medical writing one may turn to any one of the hundred contributions of the late Joseph Goldberger. Although he was better known for his researches and writings on pellagra and typhus, one of the finest gems of his brain and pen is contained in his report on the straw itch in 1910. Goldberger's model was Macaulay because the latter was a master in the use of precise English and the art of placing a wealth of ideas in a minimum of words. To come down to some strictly contemporary piece of medical writing, there were probably a hundred productions of the past year that could be classed as models. One of the best of

these was that by J. E. Moore and H. H. Hopkins—an article entitled "Asymptomatic Neurosyphilis," which appeared in the November 29, 1930, number of the Journal of the American Medical Association. It covers three and one-half pages of the journal. A brief paragraph gives the historical background. Another brief paragraph presents the general substance of the thesis—based on 123 well followed and studied patients observed over an average period of seven years—that "spinal fluid abnormalities in patients with early or late syphilis who show no clinical evidence of neuraxis involvement (asymptomatic neurosyphilis) are of grave prognostic import." A third paragraph restates briefly certain conclusions stated in previous articles from the same clinic, which conclusions are highly pertinent to the matter under discussion. The next two pages present, with the help of five short tables, the exact results of this very exact study. When one comes to the end of the body of the article he has a clearer-cut idea of the prognosis of asymptomatic neurosyphilis than he ever had before. A column of 12 very nicely stated items under Summary and Conclusions then increases the force of the article and reviews for the reader the essential points of the thesis. Among case reports, a most excellent model is found in L. J. Roberts's article in this number of the BULLETIN.

MEDICAL BOOKS

In contemplating the subject of medical books the first and principal thought that comes to mind is the enormous number of these published each year. Last year about 1,000 were published in the English language alone, these covering about 65 different branches of medicine and being put out by some 250 different publishers in the United States, England, and Canada. Such an annual output naturally involves a tremendous amount of reduplication of work, which is to say that a considerable portion of these books have but a feeble excuse for existence, much of their contents having already appeared a few hundred or a few thousand times in previous works.

Of course we must have a large number of new books each year in order to have readily at hand a literature that covers the latest advances in the various branches of medical science. But it is seriously doubted if any such output as that of the present can be needed. The present situation, making for smaller sales of each book, results in a higher price per book and brings much confusion to those who wish to select and keep up a good library.

The only remedy would seem to lie in mergers of publishing companies, since it is customary for one publisher to print not more than one book on the same subject in the same year. Such mergers appear to be as desirable as the merger of two railroads with parallel lines.

The plan would tend to limit the number of books published each year on a given subject to a few selected ones considered to be the best of the field. If publishing companies could not merge, perhaps they could come to some limitation agreements.

Making due allowance for such factors as the large number of branches of medicine, the need for new publications in order to keep in step with new advances, and the need for presenting subjects differently to different classes of readers (medical students, nurses, laymen, general practitioners, specialists, etc.) it still appears that the medical reading public would benefit if the present number of medical books published each year could be reduced by half.

Medical books, as well as medical articles, have, in general, greatly improved during the past 20 years. And the art of the publisher and printer and illustrator has contributed as much to this improvement as has the literary skill and medical knowledge of the author.

Recent examples of the superlative excellence that may be reached in the art of anatomical illustrations are the second edition of Toldt's Atlas and Warren's Handbook of Anatomy. Some of the recent surgical texts contain numerous illustrations that compare well with those of the atlases just mentioned. For many years Spalteholz's Atlas was probably the only book in existence that displayed this type of illustrative art. The X ray and photomicrograph have added greatly to the value of illustrations in texts on diagnosis and on pathology. Sante's röntgenological atlas of the chest and Buckstein's book on peptic ulcer are good recent examples of the teaching value of well chosen and beautifully reproduced X-ray photographs. Incidentally, however, both of these books are much larger than need be.

Two exceedingly commendable books on pathology, combining all the virtues of a modern medical text with a splendid array of useful illustrations have been issued since 1929, and both by the same author—William Boyd. These are his Surgical Pathology, 1929, and his Pathology of Internal Diseases, 1931. These books emanate from away up in Winnipeg, which fact shows that to be first-rate, a book does not have to come from Harvard or Hopkins or the New York or Philadelphia schools or from the Chicago or St. Louis medical centers.

The fault of a great many medical books is their size. Their size is certainly no index of their value. Sir Joshua Reynolds has well expressed this thought in his remark that a man who paints with a very large brush is not of necessity a very great painter. When a book exceeds the thousand-page mark it has a forbidding appearance and is a cumbersome thing to handle. Most readers would prefer that it be split into two or more volumes.

Books that go through several editions almost always become fatter with each new edition. Some of this growth is entirely justified—in fact, can not possibly be avoided—because of the newer knowledge that has accumulated since the appearance of the older edition, but it is more than apparent that in these revisions the authors are rarely as true in their aim of omitting what has become useless as they are in their aim of including what has become useful. At least, they seem to have carried out the job of revision with somewhat less success in this respect than we might hope or expect from the promises we find in the new prefaces. It is unfortunate that the life of a medical book is so short—about four years at most—and the only means of perpetuating its sale is by the frequent issue of new editions—bigger, though not necessarily better.

The only medical books that continue to live without the aid of frequent new editions are those on the history of medicine. The fact that Garrison's *History of Medicine* is now in its fourth edition and has reached an encyclopedic size and character since its birth about 20 years ago is not to be explained by the need for periodic resuscitation but by the growing popularity of the subject and the demand for a more complete reference work. During the last five years many monographs of moderate size have appeared on various phases of the history of medicine. Some of them make delightful reading and will probably increase in value as the years pass and may be read just as widely and profitably in 1950 as in 1930. Among such might be mentioned Dana's *Peaks of Medical History*, Long's *History of Pathology*, Newsholme's *Evolution of Preventive Medicine*, and the members of the newly launched and very commendable *Clio Medica* series, each one devoted to some special department of medical history.

Biographies of medical men have been rather numerous, but only a few seem to be very readable. Four exceptionally worth-while biographies that have appeared since 1929 are Rolleston's *Life of Allbutt*, Wilson's *Life of Mackenzie*, Eckstein's *Noguchi*, and MacCallum's *Life of Halsted*. (An informing and brilliant review of the last named—by H. L. Mencken—appears in the March, 1931, *American Mercury*.) Among the very old memoirs, none can surpass for richness of adventure those of Baron Larrey, which concern a most colorful and turbulent period of history.

For events and scenes and characters in the history of medicine in the United States, two books of great worth, and just issued this year, should be known. One is DaCosta's *Papers and Speeches*, which includes brilliant short sketches of W. W. Keen, Samuel D. and Samuel W. Gross, W. H. Pancoast, and numerous others. The other is the second edition of Packard's *History of Medicine in the United*

States. This book carries the story from early colonial times down to about 1870 and constitutes a standard reference source for the period.

While on the subject of history, I want to say that no naval medical officer can fail to have his appreciation of his calling greatly enriched if he acquires a familiarity with the past history of the Navy Medical Department and Navy Medical Corps. If the history of medicine has a lure for physicians, the history of one's particular corps should hold a double lure and should be doubly entertaining. The literature on the subject is not very extensive but it is doubtless much greater than some of you may imagine. Some of the best biographical sketches were written by Captain Pleadwell and by that brilliant historian and litterateur, the late Capt. J. S. Taylor, of our corps. Doctor Packard's new *History of Medicine in the United States* contains a chapter on the history of the Navy Medical Department which gives a rather complete account of persons, events, and other pertinent matters from the Revolutionary period down to but not including the World War. It lists a bibliography of 30 reference sources on the subject. Two other books of recent issue must be mentioned in this connection—that by Captain Holcomb, entitled “A Century With the Norfolk Naval Hospital”; and the *Life Story of Surgeon General Rixey*, which includes his autobiography, and his biography, by Captain Bell and Admiral Braisted.

It might not be a bad idea if a committee were appointed by the American Medical Association to draw up and publish each year a list of 100 medical books covering the different fields of medicine and considered by the committee the most worthy and useful books published during the previous year. The bureau follows a scheme of this sort by formulating each year a standard list of books for the Medical Department library of ships. Last year the list included 38 books and was published in the July, 1930, number of the *BULLETIN*. The new list will appear in the *BULLETIN* of July, 1931.

CLINICAL NOTES

APLASTIC ANEMIA FOLLOWING ARSPHENAMINE THERAPY

REPORT OF A CASE

By L. J. ROBERTS, Lieutenant Commander, Medical Corps, United States Navy

Aplastic anemia resulting from the administration of arsphenamine compounds is undoubtedly rare. Few of the standard textbooks of pharmacology, therapeutics, or toxicology mention it. Peterson, Haines, and Webster (1) state that arsphenamine is capable of producing aplastic anemia, an "effect as rare as it is characteristic." Gwin (2), in Osler's System of Medicine, mentions the occurrence of fatal aplastic anemia subsequent to injections of neoarsphenamine. Stokes (3) describes the condition as being due apparently to an idiosyncrasy. Phelps (4), in tabulating the severe and fatal reactions from arsphenamine compounds and tryparsamide administered in the Navy during the calendar years 1925, 1926, 1927, and 1928, found, in the series of 272,354 doses, no report of aplastic anemia, although the death in one case was due to purpura hemorrhagica. In 1929 (5) one case occurred in the Navy with fatal outcome; and again in 1930 another such case, reported by Biello and Love (18), resulted fatally. Labbe and Langlois (6) in 1919 were the first to describe this complication of arsphenamine treatment. They reported one case of severe anemia, aplastic in character, following the administration of neoarsphenamine. Dodd and Wilkinson (7) in 1928, in reviewing the literature, collected 23 cases showing granulocytic aplasia of the bone marrow resulting from arsphenamines, and of these 23, 8 showed severe anemia of the aplastic type. In addition to these 8 cases I have been able to find the reports of 11 others, a total of 19 (4) (8) (9) (10) (11) (12) (13) (14) (15) (18).

From a review of the literature it appears that aplasia of any one or all elements formed in the bone marrow may occur following the administration of one of the arsphenamines. Aplasia of the blood platelets causing purpura hemorrhagica or agranulocytosis may occur without the development of a severe degree of anemia. All degrees of depressed bone-marrow function probably occur, so that it is only the occasional case in which such a severe degree of anemia develops as to justify the designation of aplastic anemia. Moore

and Keidel (16) state that damage to the bone marrow, as indicated in the blood picture, is also present in the majority of patients reacting to arsenical drugs with a dermatitis exfoliativa. They believe that, in the presence of mild symptoms of arsphenamine poisoning with a slight rash, a blood count should be made before proceeding with further arsphenamine treatment.

The ability to produce depression of bone-marrow function does not appear to be limited to any particular form of arsphenamine compound. Sulpharsphenamine, arsphenamine, and neoarsphenamine administrations all have been followed by aplastic anemia. It is to be noted that each of these compounds contains a double benzol ring. It is well known that benzol poisoning will produce an aplastic form of anemia, and such a case has recently come under observation at this hospital. Arsenic itself will not produce this condition. Farley (13) considers it likely that, in certain persons, there is a disintegration, *in vivo*, of the arsphenamine molecule, setting free the benzol radicle so that a benzol-like action takes place.

As is the case with certain of the more common forms of arsphenamine poisoning, the amount of the drug administered before the symptoms of toxicity are noted is extremely variable. In those susceptible it appears that a very small dose may be toxic, evidence of bone marrow aplasia appearing in some reported cases early in the first course of administration.

The interval of time before symptoms appear also varies. In some cases symptoms develop very rapidly, hemorrhages being noted within a few hours after the last dose of the drug. In other cases there may be a latent period of weeks; and, in one case reported by Farley (13), the patient did not develop symptoms of severe anemia until four months after the last dose of neoarsphenamine.

Most of the reported cases exhibiting a severe degree of anemia died. In the aplastic anemia of benzol poisoning, repeated blood transfusions constitute the sovereign remedy. This has been the treatment most commonly followed in the cases following arsphenamine therapy. In one case reported by Moore and Foley (17) there was a practically spontaneous recovery without transfusion. The degree of leucopenia and the presence or absence of hemorrhages appear to be important factors in the prognosis. Farley (13) believes that transfusions should be vigorously repeated in cases of bone-marrow depression, keeping in mind that physiological paralysis rather than actual aplasia may be present in the particular case, and that the patient may be tided over this phase to recovery.

The case we have to report suggests that complete recovery may take place in the aplastic anemia following arsphenamine administration even though the degree of anemia has become extreme.

Case report.—C. J. D., Boilermaker, first class, United States Navy, age 33 years, entered United States Naval Hospital, Mare Island, Calif., on December 6, 1928, complaining of weakness and pallor.

His duties on board ship, the U. S. S. *Saratoga*, had been those usually performed by a boilermaker. For a period of about five months he had, from time to time, been exposed to the fumes resulting from the use of the oxyacetylene torch and also to cyanide fumes produced in the casehardening of steel. He had noticed some headache following the inhalation of these latter fumes. More recently he had been working a great deal inside the boilers while they were still quite hot.

There was a history, in this case, of syphilis, first discovered by means of a positive Kahn test in 1926. In the fall of that year there were eight injections of neoarsphenamine and between February 18 and April 28, 1927, eight more. In the summer of 1928 the health record indicates that neoarsphenamine was administered as follows:

	Gram		Gram
May 15, 1928-----	0.6	June 12, 1928-----	0.9
May 29, 1928-----	.9	June 26, 1928-----	.9
June 5, 1928-----	.9	July 3, 1928-----	.9

According to the health record, this made up the total treatment with arsphenamine compounds. According to his own statement, however, there had been, in addition, another course of neoarsphenamine which was completed six weeks before admission to hospital. In addition, mercury had been given rather intensively.

Eight weeks prior to his admission he first noticed that he was a trifle pale. He felt quite well, however, and continued with his duties. About two weeks before his admission he began to notice weakness and dyspnoea on exertion. For two or three days there had been slight tingling and numbness of the fingers. The day before admission there had been slight bloody expectoration. Otherwise, he had felt well. He reported to his medical officer at the suggestion of his shipmates, who noticed his unusual pallor.

Upon physical examination the pallor was obviously extreme. He appeared well nourished. The skin and mucous membranes were very pale, but there were no hemorrhagic areas. Over the flexor surfaces of the arms and upon the anterior surfaces of the thighs and legs there were numerous brownish, scaly, slightly raised patches, varying in diameter from 1 to 3 centimeters. The eyes, nose, ears, throat, heart, lungs, abdomen, and genitalia were normal. The epitrochlear and inguinal lymph glands were palpable. Blood pressure, systolic, 110; diastolic, 50. Temperature, pulse, and respi-

ration normal. Neurological examination revealed no abnormalities. The blood picture at this time was as follows:

Red blood cells.....	2,050,000	Differential—Continued.	
Hemoglobin (Sahli) _per cent.....	25	Lymphocytes.....	49
Leucocytes.....	5,450	Large mononuclears.....	5
Differential:		Transitionals.....	5
Neutrophiles.....	38	Basophiles.....	3

Considerable polychromatophilia, some poikilocytosis, slight anisocytosis and moderate achromia were noted. The average size of the red blood cells was about normal. Platelets, 260,000. Reticulocytes, 2 per cent. The coagulation time was two minutes and bleeding time two and one-half minutes.

His urine was normal and the Kahn test negative. No ova or parasites were found in the stools. An X-ray study of the gastrointestinal tract showed no evidence of significant pathology. Gastric analysis following an Ewald meal gave the following results:

Amount.....	c. c.	205
Free HCl.....	degrees	17
Total acidity.....	do.	27

The icterus index was 7.

A careful investigation failed to reveal any evidence that the patient had come in contact with any of the metals commonly known to produce anemia, nor was there any evidence of exposure to benzol or to any explosive known to affect the bone marrow. Cyanide fumes and fumes from the oxyacetylene torch were considered possible causes of the anemia, but search of the literature failed to reveal reports of any such effect from these fumes.

The patient was placed on a diet containing 300 grams of liver a day, and given iron in the form of Bland's pills. The anemia and weakness progressed, however, and on December 24, 1928, the red blood cells numbered 1,000,000, hemoglobin 25 per cent (Sahli), leucocytes 2,830, neutrophiles 36, lymphocytes 63, and eosinophiles 1. At this time a transfusion of 500 cubic centimeters of blood was given.

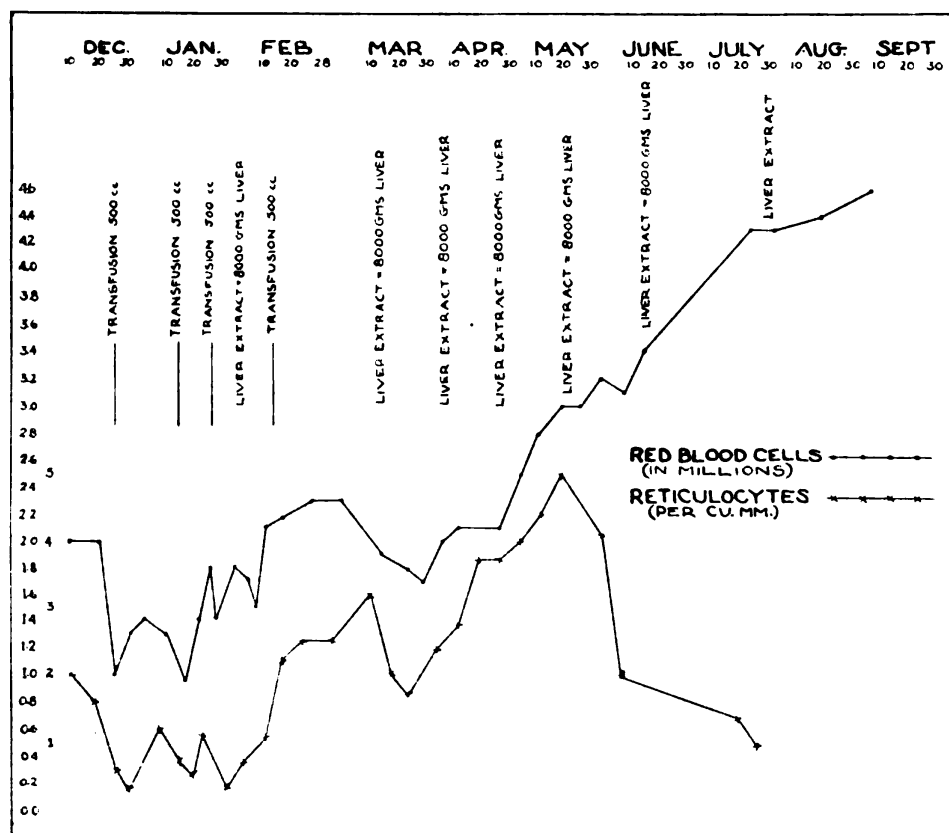
The subsequent treatment and changes in the red blood cell and reticulocyte counts are indicated in outline form in the chart.

September 11, 1929, the patient was discharged to duty apparently well. Since his return to duty, aside from an attack of acute appendicitis requiring appendectomy, he has had no further symptoms.

The bone-marrow damage in this case was undoubtedly extreme. The red blood cells and the leucocytes were the elements chiefly affected. The presence of reticulocytes and polychromatophilia indicates that diminished function rather than complete absence of

function of the blood-forming elements existed. It is possible that the type of duty which the patient was performing may have had some bearing on the production of the anemia. On the other hand, the characteristic blood picture of bone-marrow damage following neoarsphenamine therapy suggests, in the absence of any other poison known to produce bone-marrow depression, that this is a case of so-called aplastic anemia, due to an arsphenamine compound. There is nothing to indicate that the damage to the bone marrow in this particular case could have been foreseen. This form of arsphenamine poisoning appears to be unavoidable, and it is fortunate that it is rare. The presence of petechiæ or beginning anemia are certainly warning signs, however, and should call for the immediate cessation of treatment until careful blood studies have been carried out.

The transfusions in this case were undoubtedly life-saving and tided the patient over the critical period until the bone-marrow function was resumed.



Graphs showing changes in reticulocyte and red blood cell counts. Liver extract, the equivalent of 8,000 grams of liver, was administered in 3-day periods

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BIBLIOGRAPHY

- (1) Peterson, Haines and Webster: *Legal Medicine and Toxicology*, W. B. Saunders Co., 1923, 2: 256.
- (2) McCrae: *Osler's Modern Medicine*, Lea and Febiger, 1925, 2: 673.
- (3) Stokes: *Modern Clinical Syphilology*, W. B. Saunders Co., 1927, 315.
- (4) Phelps, J. R.: Reactions Incidental to the Administration of 191,778 Doses of Neoarsphenamine and Other Arsenical Compounds in the United States Navy, U. S. Nav. Med. Bull. 27: 205-223 (Jan.), 1929, and Toxic Effects of Arsenical Compounds Employed in the Treatment of Syphilis in the United States Navy, U. S. Nav. Med. Bull. 28: 659-695 (July), 1930.
- (5) The Division of Preventive Medicine: A Fatal Case of Poisoning by Neoarsphenamine Presenting Some Unusual Features, U. S. Nav. Med. Bull. 28: 243-248 (Jan.), 1930.
- (6) Labbe and Langlois: Purpura Hemorragique aigu par Intoxication Arsenicale, Bull. et Mem. Soc. Med. des Hop. de Paris, 43: 786 (July), 1919.
- (7) Dodd, Katharine, and Wilkinson, S. J.: Severe Granulocytic Aplasia of the Bone Marrow, J. A. M. A. 90: 663-665 (Mar. 3), 1928.
- (8) Ugrinmow, B., and Idelson, J.: Aplastic Anemia, Deutsches Arch. f. Klin. Med. 157: 257 (Dec.), 1927.
- (9) Well, P. E., and Isch-Wall, P.: Hemorrhagic Reaction to Arsphenamin, Presse Med. 31: 657 (July 28), 1923.
- (10) Widai, F., and Bertrand-Fontaine: Aplastic Anemia Associated with Purpuric Syndrome and Realizing the Clinical Picture of Acute Leukemia following Injections of Novarsenobenzol, Bull. et Mem. Soc. Med. de Hop. de Paris. 50: 980-985 (June 11), 1926.
- (11) Madariaga y Escobar, O.: Anemo Aleucia Hemorragica Post Arsenobenzolica, An de vias digest, sangre y nutricion 1: 107-113.
- (12) Appel, Bernard: Agranulocytic-purpuric-hemorrhagic Reaction after Neoarsphenamine, Urol. and Cutan. Rev. 34: 100-104 (Feb.), 1930.
- (13) Farley, D. L.: Depressed Bone Marrow Function from Arsphenamines, Including Type of So-called Agranulocytosis, Am. J. of Med. Sc. 179: 214-227 (Feb.), 1930.
- (14) Jacquelin and Langlois: Post-arseno-benzole Agranulocytosis, Bull. et Mem. Soc. Med. de Hop. de Paris, 3e serie: 8-17 (Jan.), 1929.
- (15) Vedel, Giraud and Giraud: Anemic Pernicieux Aplastique Post-novarsenobenzolique avec Hemorragies, Purpura et Attiente Hepatique, Ann. de Derm. and Syph. 4: 712 (December), 1923.
- (16) Moore, J. E., and Keldel, A.: Stomatitis and Aplastic Anemia due to Neoarsphenamine, Arch. Derm. and Syph. 4: 169-176 (August), 1921.
- (17) Moore, J. E., and Foley, F. E. B.: Serious Reactions from the Salvarsan and Diarsenal Brands of Arsphenamin, Arch. Derm. and Syph. 38: 25-42 (January), 1920.
- (18) Biello, J. A., and Love, J.: A Case of Anhematopolesis following Neoarsphenamine Therapy in the Treatment of Syphilis, U. S. Nav. Med. Bull. 29: 76-84 (January), 1931.

SOME EXPERIENCES WITH QUINIDIN IN AURICULAR FIBRILLATION

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Auricular fibrillation (delirium cordis, pulsus irregularis perpetuus, mitral pulse), now considered the most frequent of all cardiac arrhythmias, was first recognized in man by Cushny and Ed-

monds in 1901. "The term, auricular fibrillation, describes an activity of the auricular walls in which fibers or group of fibers contract without reference to other fibers or group of fibers." The result is an incoordination of contractions and a consequent disturbance of rhythm with more or less loss of cardiac efficiency.

At the present time it is believed that the disorganization of the auricular activity is due to a defect in conduction, that there is a perpetuating ring of excitation located in the right auricle at the mouth of the superior vena cava, the so-called circus movement.

Auricular fibrillation has been divided into three types, based upon etiology: (1) The rheumatic, (2) the nonrheumatic, and (3) the paroxysmal or transient type.

The rheumatic type is found in chronic valvular disease in which mitral stenosis is the most frequent lesion.

Under the nonrheumatic type occur the chronic cardiovascular-renal conditions, general arteriosclerosis, the senile heart, chronic myocarditis, and certain toxic disturbances of the thyroid.

The paroxysmal or transient type may occur in certain acute infectious diseases, such as pneumonia, acute rheumatic fever, influenza, diphtheria, also following surgical anesthesia, and with the toxic effects of digitalis or tobacco. There are a number of other factors listed as possible causes.

In 1910, Rothberger, Winterberg, and Lewis, proved, by means of the electrocardiograph, that this cardiac arrhythmia was an auricular fibrillation.

The electrocardiogram shows the absence of the P waves and that during the normally quiet diastole there appear fibrillary waves, either coarse or fine.

One may fairly easily recognize the condition by palpation of radial arteries or by obtaining a tracing of the radial pulse and noting the irregular arrhythmia present. Both the rhythm and force are irregular. Auscultation of the precordium and at the same time palpation of radial pulse will usually disclose a pulse deficit. This pulse deficit is considered by some to have a prognostic value. The greater the deficit, the graver the prognosis.

Symptoms vary in individuals. Some patients may be unaware of the disturbance, but the majority of them have a sense of heart consciousness or one or more of the following symptoms: A fluttering or thumping in the precordium, faintness, palpitation, pain over the heart, breathlessness, indigestion, dyspnea, or headache.

Physical signs vary somewhat, depending upon the etiology. The blood pressure frequently fluctuates widely, both the diastolic and systolic. In patients with mitral stenosis the presystolic murmur may disappear or be replaced by a mid-diastolic rumble, but when normal rhythm is established it reappears.

The value of quinidin sulphate in treating auricular fibrillation was first reported by Frey in 1918. Since that date many practitioners have used it with varied results. The overemphasis of the danger of embolism in quinidin therapy has probably deterred many others from using it. However, a number of cardiologists, who assumed that a heart with a normal sinus rhythm is more efficient than one that is fibrillating, have used it in a large number of cases with the belief that it is of real value. The drug is supposed to exert its influence by lengthening the refractory period of cardiac muscle, thus abolishing the circus movement.

Most authors are agreed that digitalization before administration and maintained during quinidin treatment is desirable. It is also believed that the patient should be confined in bed with an electrocardiograph available.

During the past 20 months at the Naval Hospital, San Diego, Calif., there have come under my observation approximately 30 patients with cardiovascular diseases who had auricular fibrillation. Of this number, 13 were selected for quinidin therapy.

The plan and dosage as suggested by H. Spiro and W. W. Newman (3) were used.

Following are the abstracted case histories of the patients who were treated with quinidin:

CASE 1.—B. G. C., V. B. P., age 49. Admitted September 11, 1929. Diagnosis: Hyperthyroidism; myocarditis, chronic, with auricular fibrillation.

Complaints.—Weakness, shortness of breath, swelling of ankles, and nervousness.

Examination.—Fairly well developed and nourished; somewhat dyspneic and nervous.

Eyes showed no exophthalmus; extra-ocular movements normal.

Neck: Thyroid symmetrically enlarged; no pulsations; no bruit.

Heart: Apex beat palpable, fifth interspace, just outside of nipple line. There was an irregular irregularity with a pulse deficit. Rate, 86 per minute. No definite murmur heard. Blood pressure, 142/65.

X ray: Heart enlarged in all directions; arch widened.

There was a fine tremor of tongue and hands. Ankles showed slight edema.

Rest in bed, high caloric diet, and digitalis were prescribed.

Electrocardiogram, September 12, 1929: "Auricular fibrillation of the fine type, with ventricular rate of 90. He also has premature contractions at irregular intervals, some arising from the right and some from the left ventricle; occasionally there will be a short series of two or three premature contractions."

Series of basal metabolism tests.—September 14, 1929, plus 39; September 16, 1929, plus 35; September 18, 1929, plus 51.

Digitalization considered satisfactory on September 21, 1929; pulse averaging 70 to 80 per minute; fibrillation still present. Quinidin medication begun with 4 grains and increased 8 grains daily until September 27, 1929, when normal rhythm was established; then quinidin was reduced to 2 grains three times daily.

Electrocardiogram.—"Regular rhythm. Rate: Auricular, 60; ventricular, 60. T-2 is diphasic, with a depression of the S and T interval; there are evidently some myocardial changes."

October 2, 1929: Patient complained of some gastro-intestinal discomfort and diarrhea, which subsided upon reduction of the dosage of quinidin.

October 6, 1929: Allowed up with gradual increase of activity. Quinidin, 2 grains twice daily.

Series of basal metabolism tests: October 1, 1929, plus 14; October 4, 1929, plus 31; October 5, 1929, plus 39; October 7, 1929, plus 37.

Thyroidectomy was advised but patient desired to have further treatment in a hospital near his home in San Francisco.

October 9, 1929: He was discharged with a normal rhythm maintained.

We have no further information concerning him.

CASE 2.—E. B., V. B. P., age 53. Admitted December 20, 1929. Diagnosis: Myocarditis, chronic, with auricular fibrillation (exophthalmic goiter).

Complaints.—Precordial pain, nervousness, dyspnea, palpitation, rapid and irregular heart action.

Past history.—Thyroidectomy in October, 1920, United States naval hospital, San Diego, Calif. Following operation, his condition improved some but he has never been able to work; has been nervous, dyspneic, and occasionally has edema of ankles and pain over precordium.

Examination.—General appearance, very emaciated man; very dyspneic; eyes prominent; vessels in neck pulsated irregularly.

Mouth: Poor dental hygiene; number of teeth missing; others carious.

Neck: Scar from operative incision. Thyroid not palpable. Conspicuous pulsation of vessels.

Heart: P.M.I. in sixth interspace at the nipple line; apparently not enlarged; rythm very irregular; sounds of fair quality; no definite murmurs. Peripheral vessels very sclerotic and tortuous. Pulse, 84; blood pressure 150/25.

Extremities: Fine tremor of hands; no edema of ankles.

Electrocardiogram, December 20, 1929: "Auricular fibrillation (fine); ventricular rate, 92. Inverted T-1 is probably due to digitalis as he had been taking heavy doses prior to admission."

Treatment.—Rest in bed, morphin sulphate, one-eighth grain as required for pain, powdered digitalis leaves, 1½ grains twice daily, high caloric diet.

January 2, 1930: Kahn test four plus.

January 6, 1930: Condition seemed improved. Pulse, 70 to 90 per minute. Fluoroscopic examination of heart showed ventricles contracting strongly but irregularly. Auricles seemed to be pulsating with ventricles.

January 8, 1930: Quinidin therapy begun with 4 grains, increased 8 grains daily, and continued until January 13, 1930, on which date he received 40 grains without any apparent effect upon the rhythm. He began to complain of toxic symptoms, so dosage was reduced to 8 grains daily.

Electrocardiogram: "Heart still fibrillating. T-waves inverted throughout; one premature ventricular contraction recorded. No change noted since quinidin was started."

January 20, 1930: Quinidin discontinued entirely.

January 30, 1930: Feeling much better, but heart still fibrillating. No further attempt was made to change the rhythm and patient was discharged.

April 24, 1930: Readmitted to hospital for extraction of carious teeth. Condition was fair otherwise.

Electrocardiogram, April 26, 1930: "Auricular fibrillation. The ventricular rate is slower (70) than in previous electrocardiograms; otherwise the electrocardiogram closely resembles most of those taken in January.

Dental extraction completed; he was discharged July 18, 1930. No attempt was made to treat his heart condition at this time.

CASE 3.—H. C. R., V. B. P., age 46. Admitted January 17, 1930. Diagnosis: Myocarditis, chronic, valvular heart disease, mitral insufficiency with auricular fibrillation.

Complaints.—"Gas on stomach," irregular heart action, weakness, and pain in lower left chest.

Examination.—Well developed and fairly well nourished; some respiratory distress.

Heart: No definite enlargement. Rate 80; very irregular with a pulse deficit with occasional extra systoles. Soft systolic murmur heard best over apex and transmitted to the axilla.

Abdomen: Liver not palpable but slightly tender on deep palpation in right upper quadrant.

There was no edema of ankles.

Electrocardiogram, January 17, 1930: "Auricular fibrillation. Auricular rate approximately 400; ventricular, 88. Inverted T 1-2. Extensive myocardial changes evidently present."

Bed rest and digitalis prescribed.

January 24, 1930: Pulse rate 70 to 80 per minute. Quinidin begun with 4 grains first day with daily increasing dosage. Quinidin without digitalis was continued until February 3, 1930, at which time it was discontinued. Heart was still fibrillating, although he had received about 72 grains of quinidin within 24 hours.

Electrocardiogram, February 4, 1930: "The auricle is still fibrillating. Ventricular rate is 70. T-1 is now diphasic, being flatter than in previous electrocardiograms. T-2 is inverted. There are occasional premature ventricular contractions."

February 6, 1930: Patient stated he felt quite well and desired to be discharged in order to attend to some urgent personal business. (Although normal rhythm was not established, had he remained in the hospital another attempt would have been made. It is possible that digitalis might have helped in establishing normal rhythm had it been continued and quinidin used a little longer.)

CASE 4.—J. A. B., V. B. P., age 36. Admitted February 13, 1930. Diagnosis: Myocarditis, chronic, hyperthyroidism and auricular fibrillation. (This was the third admission to this hospital within four years. All previous electrocardiograms showed auricular fibrillation.)

Complaints.—Irregular and rapid heart, burning sensation over the heart, nervousness and excitability.

Past history.—Had had palpitation and irregular pulse since 1919 (11 years). Has had hyperthyroidism for about four years and has been treated for it.

Examination.—Well developed and nourished; somewhat nervous and irritable.

Eyes.—Appeared normal; previous records showed slight bilateral exophthalmus.

Neck.—Thyroid gland distinctly palpable. Some enlargement of right lobe; no nodules.

Heart.—Apparently slightly enlarged to left.

X-ray report: "Hypertrophy of heart." No thrills; no definite murmurs but there was an irregular irregularity with pulse deficit. Pulse rate, 84 to 90 per minute. Blood pressure, 90/60.

Electrocardiogram, February 18, 1930: "Auricular rate approximately 400, ventricular rate, 90. Auricular fibrillation, the fibrillary waves being coarse type. There are occasional premature contractions which arise from a focus in the left ventricle. The Q. R. S. is of good amplitude and the time interval is short in all leads. The T waves can not be distinguished. They are of such low amplitude as to be obscured by the coarse fibrillary waves."

A series of basal metabolism tests showed rates varying from minus 19 to plus 4.

Bed rest with digitalis was prescribed.

February 18, 1930: Pulse rate, 60 to 70 per minute. Quinidin sulphate was begun, 4 grains the first day, with an increase of 8 grains daily. Digitalis leaves, 1.5 grains twice daily, continued.

February 25, 1930: Complained of headache and some nausea.

Electrocardiogram, February 25, 1930: "Auricular rate, 240; ventricular rate, 80. Auricular flutter; the condition is changed from fibrillation to regular three-to-one flutter. One ventricular premature contraction is recorded."

February 26, 1930: Quinidin and digitalis continued. Patient somewhat nauseated and complained of headache and diarrhea.

February 27, 1930: Normal rhythm established.

Electrocardiogram, February 27, 1930: "Auricular and ventricular rate, 70. Normal rhythm has been established; the T wave is of poor amplitude and diphasic in leads 1 to 2. Otherwise normal."

On the day prior to establishment of normal rhythm he received approximately 88 grains of quinidin.

March 4, 1930: Normal rhythm maintained. Allowed up with gradual increasing activity. Patient stated he felt the best he had felt for years.

Electrocardiogram, March 6, 1930: "Normal rhythm is still present. No premature contractions noted."

March 7, 1930: Discharged from the hospital. Since discharge he has been seen and examined every month or six weeks for over one year. Normal rhythm continues, although he is quite active. He is receiving no medication at present.

CASE 5.—W. L. T., C. M. M., U. S. N., age 41. Admitted March 4, 1930. Diagnosis: Myocarditis, chronic, auricular fibrillation.

Complaints.—Weakness, tired easily, rapid and irregular heart, and headache.

History.—Two days before admission was working very hard. Felt very tired and went home. Next day felt very weak, had a headache, and heart seemed to flutter.

Examination.—Well developed and nourished. Somewhat pale and had rather anxious expression. Lungs clear.

Heart not apparently enlarged. No thrills; no murmurs; sounds of rather poor quality. Rate very rapid and irregular, approximately 160 per minute. Blood pressure 110/80.

Electrocardiogram, March 5, 1930: "Auricular rate approximately, 350; ventricular, 160. Auricular fibrillation."

Bed rest and digitalization begun.

March 10, 1930: Quinidin begun; 2 grains three times a day, increasing 6 grains daily.

March 18, 1930: Complained of some dizziness. Medication continued.

March 20, 1930: Normal rhythm established. Rate, 76.

Electrocardiogram, March 20, 1930: "Normal rhythm established. Rate, 76. Slight prolongation of conduction time between auricles and ventricles."

March 21, 1930: Quinidin continued on fixed dosage; 2 grains three times daily.

March 26, 1930: Felt well; allowed up with gradual increasing activity.

April 2, 1930: All medications discontinued.

January 28, 1931: Patient feels fairly well but tires rather easily; normal rhythm has been maintained.

Electrocardiogram, January 28, 1931: "Normal rhythm. Rate, 106. Notching of Q. R. S. in lead 3 indicates slight myocardial changes."

CASE 6.—C. C. C., V. B. P., age 52. Admitted April 21, 1930. Diagnosis: Hemorrhoids, valvular heart disease, combined lesions, aortic and mitral.

Complaints.—Hemorrhoids, shortness of breath, dry cough, and swelling of ankles.

Examination.—Fairly well developed, but poorly nourished.

Chest: Somewhat barrel-shaped; mobility and resonance good; no evidence of fluid.

Heart: P. M. I., sixth interspace about 3 centimeters outside of nipple line. Blowing systolic murmur heard over apex and soft systolic murmur over aortic area. Rhythm, regular; rate increased 112 per minute. Blood pressure, 112/46.

Rectum: Showed three large protruding piles.

Bed rest with digitalis was prescribed.

May 3, 1930: Patient stated he felt much better. Pulse rate, 60 to 80 per minute. Under caudal anesthesia, three internal piles removed by clamp and suture method.

May 23, 1930: Not feeling so well. Complained of weakness, dyspnea, and insomnia.

Electrocardiogram, May 23, 1930: "Auricular rate approximately 330; ventricular rate, 62. Auricular fibrillation. Abnormal T waves, leads 1 to 2. The ventricular rate is slow, which is a favorable symptom. An electrocardiogram taken last November showed a normal rhythm except for occasional premature contractions."

May 26, 1930: Administration of quinidin, 2 grains three times a day begun, increasing 4 grains daily. Digitalis continued.

May 31, 1930: About 8 p. m. became rather restless and complained of some pain in chest. He was given morphin sulphate, $\frac{1}{8}$ grain.

June 1, 1930: At 9 a. m. stated he felt fairly well. At 2.25 p. m., while sitting up, suddenly became cyanotic and collapsed. Efforts to revive him were of no avail.

Autopsy findings.—1. Chronic endocarditis with mitral and aortic valvular sclerosis and incompetency. Thrombi were formed on the mitral valve. 2. Chronic myocarditis. 3. Old adhesive pericarditis. 4. Old perisplenitis and perihepatitis. 5. Chronic passive congestion of liver, spleen, and kidneys.

Lungs: Slight anthracosis. Posterior portions of both lungs congested. Otherwise normal.

CASE 7.—F. N. D., gunnery sergeant, United States Marine Corps, age 30. Admitted May 15, 1930. Diagnosis: Valvular heart disease, mitral stenosis with auricular fibrillation.

Complaints.—None; stated he did not tire easily and was not short of breath.

Past history.—Had a stroke of paralysis in May, 1929, and was in hospital for six weeks. His recovery from paralysis was complete. At the same time it was noted he had auricular fibrillation. He was given quinidin and normal

· rhythm was restored. In April, 1930, was readmitted to Mare Island Hospital with a diagnosis of mitral stenosis and auricular fibrillation. On May 15, 1930, was transferred to this hospital. No quinidin had been given him at Mare Island.

Examination.—Chest: Normal contour; expansion good and equal; no areas of dullness; no râles.

Heart: Apparently enlarged to the left; precordial heaving; ventricular contractions were irregular and tumultuous; no definite murmurs heard. Blood pressure, 120/80.

X ray, May 19, 1930: Heart considerably enlarged. Aortic type; arch a little wide. Lungs showed a little congestion.

Electrocardiogram, May 17, 1930: "Auricular rate approximately 360; ventricular 70 to 88. Auricular fibrillation. Fibrillation is coarse. T waves are positive and of good amplitude. Q. R. S. is normal. The heart muscle is apparently in good condition for a fibrillating heart."

Bed rest with digitalis was prescribed.

May 26, 1930: Quinidin, 2 grains three times a day, increased 4 grains daily, and digitalis was continued for four days when pulse rate dropped to 58 per minute, then digitalis was stopped, but increasing dosage of quinidin continued.

June 2, 1930: Normal rhythm established. Quinidin decreased to 2 grains three times daily.

Electrocardiogram: "The rhythm is now regular. The only abnormality noted is in the prolonged conduction time between the auricle and ventricle, being 0.24 of a second."

June 9, 1930: Allowed up and about with gradual increasing activity.

June 16, 1930: Normal rhythm maintained. Stated he felt well in every way. All medications discontinued.

Electrocardiogram, June 16, 1930: "The electrocardiogram is normal."

July 15, 1930: Discharged from hospital with normal rhythm maintained.

He has not been seen since discharge.

CASE 8.—A. S., V. B. P., age 47. Admitted July 11, 1930. Diagnosis: Myocarditis, chronic, with auricular fibrillation and decompensation.

Complaints.—Weakness, shortness of breath, and swelling of feet.

Onset.—About six months before.

Examination.—Heart: P. M. I. diffuse, extending about 2 centimeters to left of nipple line. There was an irregular irregularity with a pulse deficit. Rate, 80 to 90 per minute. Blood pressure, 125/80. No thrills; no murmurs; some edema of ankles.

He was confined to bed and powdered digitalis leaves, 1.5 grains three times a day, prescribed.

X ray: Heart enlarged in all directions. Arch rather wide. Lungs: Negative. Kahn test four plus.

July 17, 1930: Markedly improved. Edema of ankles gone.

Electrocardiogram, July 17, 1930: "Auricular fibrillation; ventricular rate, 70. Fibrillary waves are practically flat. T wave lead 2 is inverted. All waves are of low amplitude. Absence of T-1 and low amplitude of T-2 and T-3 indicate myocardial changes."

August 16, 1930: Confined to his bed and administration of quinidin sulphate begun with 4 grains the first day and increased 8 grains daily. Small daily dosage of digitalis continued.

August 20, 1930: About 2.30 a. m. became very restless and complained of weakness, but soon felt better and went to sleep. At 9 a. m. pulse was regular; rate 50 per minute. Quinidin decreased.

Electrocardiogram, August 21, 1930: "Auricular fibrillation has ceased. Auricular impulses are supraventricular, but are not from sinus node. Premature contractions arising in either ventricle. Rate 90."

August 29, 1930: Allowed up with gradual increasing activity; all medications discontinued.

September 5, 1930: Felt well.

Electrocardiogram: "Rate 60. No P waves visible. Heart is regular. P waves are probably buried in Q. R. S. group. Nodal rhythm, auriculoventricular."

September 17, 1930: Up and about. No complaints. Pulse rate, 50 to 68 per minute. All medications discontinued.

September 23, 1930: Cardiac rhythm regular. Discharged from hospital this date. Has not been seen or heard from since discharge.

CASE 9.—M. B. M., V. B. P., age 43. Admitted September 17, 1930. (Third admission to this hospital.) Diagnosis: Mitral insufficiency, myocarditis, chronic, with auricular fibrillation and decompensation.

Complaints.—Shortness of breath on mild exertion, weakness, numbness of hands and feet.

Examination.—Heart enlarged transversely. Left border 2 centimeters to left of nipple line. Soft systolic murmur over apex. Liver 2 centimeters below costal margin. No edema of legs.

X ray: Heart enlarged to left; arch moderately widened.

Electrocardiogram, September 19, 1930: "Auricular fibrillation with ventricular rate of 90; rhythm very irregular."

Bed rest with digitals until September 29, 1930. Pulse rate then varied between 60 and 72 per minute. Quinidin sulphate begun, 4 grains first day, 8 grains second day, then increased 8 grains daily until October 10, 1930, when normal rhythm was established. On the day prior to establishment of normal rhythm he received 80 grains of quinidin.

Electrocardiogram, October 10, 1930: "Normal rhythm is established. Rate, 70; regular. The duration of Q. R. S. is now 0.12 second, which indicates myocarditis."

He had become somewhat nauseated, had slight diarrhea, and complained of some dizziness about this time. He stated that he knew when change in heart rhythm had occurred.

October 19, 1930: Allowed up and about.

October 23, 1930: After some overexertion, fibrillation returned. He was confined to his bed and quinidin again prescribed with increasing dosage until October 30, 1930, when normal rhythm was reestablished.

Electrocardiogram, October 30, 1930: "Normal rhythm established; rate 70. There is slurring in all Q. R. S. complexes, which indicates myocarditis."

Quinidin was decreased to 4 grains three times daily.

November 14, 1930: Allowed up and about ward.

December 4, 1930: All medication discontinued. Patient gradually increased his activities without any apparent ill effects except pulse rate varied between 80 and 100.

Electrocardiogram, December 29, 1930: "Rate, 96; rhythm regular; within the range of normal."

January 5, 1931: Discharged from hospital. Normal rhythm maintained. Letter from patient about two weeks later stated his pulse was still regular.

History and records showed this man had had an auricular fibrillation since 1919 (about 11 years.)

CASE 10.—S. R., V. B. P., age 47. Admitted October 2, 1930. Diagnosis: Valvular heart disease, combined lesions, aortic and mitral myocarditis, chronic, with auricular fibrillation, and decompensation.

Complaints.—Shortness of breath, palpitation of heart.

History.—In June, 1929, he was admitted to Veterans' Bureau Hospital, Fort Thomas, Ky. Was in hospital 12 days; was given digitalis; symptoms and swelling of ankles disappeared. Has taken digitalis since that date. In July, 1930, began to feel worse, with increasing shortness of breath and discomfort.

Examination.—Obese man; weight, 210 pounds, with marked dyspnea.

Heart: Markedly enlarged in all directions. No definite murmurs heard; very marked irregularity. Rate so rapid that it could not be counted accurately, over 160 per minute. Blood pressure 140/100; no edema of ankles.

X ray: October 3, 1930. Heart grossly enlarged in all directions. Arch moderately widened. Lungs showed passive congestion.

Electrocardiogram, October 3, 1930: "Auricular fibrillation with ventricular rate of 166. Right ventricular preponderance."

Bed rest, morphin sulphate, one-fourth grain as required, and digitalis was prescribed.

October 13, 1930: Much improved. Pulse rate, 70 to 90; digitalis continued.

October 31, 1930: Up and about ward, with gradual increasing activity; no complaints.

November 17, 1930: Confined to bed. Quinidin begun with 2 grains three times daily with increasing dosage.

November 22, 1930: Regular rhythm established.

Electrocardiogram November 22, 1930: "Regular rhythm. Rate, 90. Q.R.S. duration, 0.12 second, which indicates considerable myocardial changes. Right ventricular preponderance."

Electrocardiogram December 1, 1930: "Regular rhythm maintained. Rate, 90. Conduction time, P. R., 0.16 second; Q.R.S., 0.10 second."

December 5, 1930: Discharged this date. Stated he felt fine. Weight, 199 pounds.

Has not been seen since discharge.

CASE 11.—J. F. C., V. B. P., age 32. Admitted December 2, 1930. Diagnosis: Mitral stenosis, myocarditis, chronic, with auricular fibrillation.

Complaints.—Shortness of breath, easily fatigued, weakness, some pain over heart, and a cough at times.

History.—Has had heart disease since recovery from influenza in 1918. About one year ago condition became worse. Was in Veterans' Bureau hospital at Omaha, Nebr., from January until May, 1930. Diagnosis, he was told at that time, was mitral stenosis, dilatation of heart, with marked cardiac arrhythmia.

Examination.—Fairly well developed but poorly nourished. Apparent age, 40 years. Evident respiratory distress.

Chest: Few moist râles at base of right lung.

Heart: Apparently enlarged considerably. P. M. I., sixth interspace 10 centimeters from midsternal line. Rhythm very irregular: rate varying from 80 to 96 at rest. No definite murmur heard. Sounds of fair quality. Blood pressure 100/70.

Electrocardiogram, December 3, 1930: "Auricular fibrillation with a ventricular rate of 134. Rhythm very irregular. Left ventricular preponderance."

Bed rest, powdered digitalis leaves prescribed. Condition improved steadily. Pulse rate dropped till the average was 72 per minute, but fibrillation continued.

December 26, 1930: Quinidin medication started with 2 grains three times daily with an increase of 8 grains a day. Digitalis continued.

December 29, 1930: Normal rhythm established. Patient stated he was aware during the night when the change of rhythm had occurred. Auscultation showed a definite presystolic murmur. Quinidin was reduced to a fixed dosage and digitalis continued.

Electrocardiogram, December 29, 1930: "Regular rhythm established. Rate, 90. Inverted T waves in leads 1 and 2 indicate considerable myocardial change."

January 8, 1931: Allowed up with gradual increasing activity. Digitalls and quinidin continued. Normal rhythm maintained.

January 29, 1931: Stated he felt better than at any time within past year. Had gained over 15 pounds in weight; normal rhythm maintained.

February 2, 1931: Had an attack of palpitation. Pulse appeared somewhat irregular. Rate, 70 to 100. Ordered to bed. Electrocardiogram, however, showed normal rhythm maintained; rate, 110.

February 9, 1931: Up and about at liberty. Normal rhythm maintained; rate, 70 to 90.

February 20, 1931: Discharged from hospital this date with normal rhythm.

CASE 12.—J. M. B., V. B. P., age 36. Admitted November 7, 1930. Diagnosis: Chronic valvular heart disease, mitral stenosis with auricular fibrillation.

History.—Heart disease since an attack of influenza in 1919.

Complaints.—Soreness across the chest, shortness of breath, dizziness, coughing, and spitting of blood.

Examination.—Heart enlarged to left; sounds rather indistinct; mitral stenotic murmur heard. Rhythm very irregular. Evidence of passive congestion in bases of lungs. Condition such that thorough examination deemed inadvisable. Blood pressure 120/98.

X ray, November 8, 1930: Heart enlarged in all directions, especially to the left. Rather marked passive congestion in the lungs.

Electrocardiogram, November 8, 1930: "Right ventricular preponderance. Rate, 110."

Bed rest and digitalis prescribed.

November 9, 1930: Coughed up more blood. Condition considered critical.

November 10, 1930: Morphine sulphate, one-eighth grain as required for precordial pain. Digitalis pushed.

Electrocardiogram, November 10, 1930: "Auricular fibrillation, coarse variety. Ventricular rate, 114."

November 14, 1930: Improved; pulse rate, 80. Fibrillation still present. Digitalis continued.

December 26, 1930: Improved. Confined to bed. Fibrillation still present. Quinidin, 2 grains three times daily with an increase of 8 grains daily. Digitalis continued.

Electrocardiogram, December 29, 1930: "Regular rhythm established; rate, 140. The Q. R. S. complex in lead 2 has an amplitude of 0.31 millimeter which is 0.15 millimeter more than the upper limit of normal. Apparently heart is beating very forcibly."

Electrocardiogram, December 31, 1930: "Auricular fibrillation has returned. Ventricular rate, 86."

January 3, 1931: Patient became nauseated. Pulse rate dropped to 50 per minute. Digitalis and quinidin discontinued.

January 13, 1931: Quinidin readministered, starting with 2 grains twice daily and increasing 4 grains daily.

January 15, 1931: Regular rhythm reestablished. Rate, 80. A fixed dose of quinidin and digitalis prescribed.

February 10, 1931: Up and about with guarded activity; regular rhythm maintained.

February 20, 1931: Regular rhythm maintained. Feeling well. Definite diastolic murmur present over mitral area.

CASE 13.—F. D., C. B. M., F. N. R., age 42. Admitted December 30, 1930. Diagnosis: Mitral stenosis, chronic myocarditis, with auricular fibrillation.

Complaints.—Shortness of breath, fatigue, and headaches.

History.—A diagnosis of mitral insufficiency made in March, 1922. December, 1927, a diagnosis of myocarditis, chronic, was made. Was readmitted to this hospital February 10, 1928, with a diagnosis of myocarditis, chronic, with auricular fibrillation. Ventricular rate, 180. He was given quinidin, 8 grains every four hours at first and later 5 grains every four hours until February 28, 1928; fibrillation continued and the drug was stopped.

Patient stated he had chorea when a child. Heart disease began in 1918 following an attack of acute rheumatic fever. Had a stroke of paralysis in 1917; complete recovery followed. Had been confined at home for past three months and was receiving digitalis.

Examination.—Fairly well nourished; slightly cyanotic in appearance.

Heart enlarged; rhythm very irregular. Blowing diastolic murmur best heard over mitral area.

X ray: Heart enormously hypertrophied and contour indicates combined lesion.

Electrocardiogram, December 30, 1930: "Auricular fibrillation, coarse type. Ventricular rate, 110."

Bed rest and digitalis prescribed.

January 21, 1931: Improved; still fibrillating. Rate of pulse, 60 per minute.

January 23, 1931: Quinidin started with 4 grains the first day and increased 4 grains daily until January 29, 1931, when normal rhythm was established.

Electrocardiogram: "Auricular and ventricular rates, 68. Regular rhythm. T-1 and T-2 diphasic which may indicate myocardial changes."

Electrocardiogram, February 2, 1931: "Regular rhythm maintained."

Digitalis and 4 grains quinidin continued.

February 10, 1931: Rhythm regular; rate, 70. Stated he felt the best he has felt for a number of years. Allowed up with gradual increasing activity. Medication continued.

February 16, 1931: Fibrillation returned.

Electrocardiogram: "Auricular fibrillation has returned. Ventricular rate, 90. Fibrillation of coarse type."

He was again confined to bed and quinidin increased 4 grains daily until February 20, 1931 when a regular rhythm was established, and to date it has been maintained.

COMMENT

In cases 2 and 3 there may or may not have been response to the drug if larger doses had been used or if another attempt had been made at a later date.

The patient in case 6 was probably not a suitable subject for quinidin since autopsy showed an active endocarditis. Just what part quinidin played in causing his death has not been fully determined.

CONCLUSIONS

In view of the fact that nearly every patient in whom normal rhythm was established stated he felt better, we believe that the use of quinidin was justified.

Believing that auricular fibrillation does decrease cardiac efficiency and may decrease life expectancy, establishment of normal rhythm is desirable.

BIBLIOGRAPHY

- (1) Cecil: Textbook of Medicine, 1929.
- (2) Cohn, A. E., Nelson: Loose-Leaf Living Medicine, Volume IV.
- (3) Spiro, H., and Newman, W. W.: Quinidin in Auricular Fibrillation: A Fairly Safe Indication for Its Use. *J. A. M. A.*, 91:1268, October 17, 1928.
- (4) Barrier, C. W.: The Use of Quinidin in Treatment of Ectopic Rhythms. *J. A. M. A.*, 89:742, September 3, 1927.
- (5) Wolff, L., and White, P. D.: Auricular Fibrillation. Quinidin Sulphate Therapy. *Arch. Int. Med.*, 43:653, May, 1929.
- (6) General Medicine: Practical Medicine Series, 1929 and 1930. The Year Book Publishers, Chicago.

PSYCHOGENIC AMBLYOPIA¹

By E. C. EBERT, Lieutenant Commander, Medical Corps, United States Navy

Amblyopia is a reduction of acuteness of vision which can not be relieved by glasses and which is not dependent upon any physical changes in the eye. Thus it must be dependent either upon (1) a lesion at some point in the optic tract, such as the lesions of toxic or infectious or organic brain-disease origin, or (2) upon a mental disturbance which has in some way brought about an inability of the higher centers to properly receive and interpret the visual stimuli that are brought to them.

The first of these classes comes under the heading of "neurogenic amblyopia." We have all seen a variety of cases of this neurogenic type and we are satisfied that we have a fair understanding of their pathogenesis.

The second class, however, leaves us completely at a loss for any definite and adequate explanation as regards the exact mechanism of the disorder. This type of case has been variously termed, but I prefer the term "psychogenic amblyopia," which, though it covers a multitude of ignorance, is more descriptive and definitive than that of "hysteria" or of several others that have been used. Hysteria would seem to be a somewhat unfortunate label for certain of these cases, as there is little hysterical about them, and they do not conform (except, perhaps, in their amenability to certain forms of treatment) to our usual concept of hysteria.

¹ Read at staff conference of Naval Medical School and Washington Naval Hospital. U. S. Naval Medical School, Washington, D. C., Feb. 6, 1931.

All degrees of amblyopia are found in this class, ranging from quite mild visual disturbances to total blindness. Patients suffering from the milder forms often spend years in making the rounds of many ophthalmologists, all of whom make slight changes in the glasses, before some more discerning one hits upon the underlying nature of the trouble. This state of affairs has led Derby (1) to remark, in a recent article on what he calls "ocular neuroses" that ophthalmologists have produced more ocular neuroses than they have cured.

One does not need to be a trained psychologist or psychiatrist, either for the diagnosis or the treatment of these cases. All that is needed is a little understanding of human nature, and enough sympathy and common sense to win the confidence of the patient.

There is nothing new about the great value of suggestion in the treatment of this disorder. Indeed, both in the book of St. Mark and St. John we are told of the quickness and ease with which Christ restored vision to the blind. To quote from St. Mark: "The blind man (Bartimaeus) said unto him, 'Lord, that I might receive my sight.' And Jesus said unto him, 'Go thy way; thy faith has made thee whole.' And *immediately* he received his sight, and followed Jesus in the way."

In two of the three cases of complete blindness of psychic origin that I have observed and treated, the blindness not only developed instantaneously, but was later made to disappear, by suggestion, in the sudden fashion that characterized the Biblical "miracles."

In both of these cases the element of fear seemed to be largely responsible for the condition, and the element of complete confidence in the physician largely responsible for the cure.

The first case, that of a very intelligent machinist's mate, aged 24, was seen on board the U. S. S. *Arkansas* in 1920. While drinking ashore, he had listened to considerable talk on the subject of wood-alcohol poisoning. Some hours later, while sitting at the evening meal mess table aboard ship it seemed to him that the lights suddenly went out. He was admitted to the sick bay, and the next morning a complete examination of the eyes, including a view of the eye grounds, was entirely negative. There were no hysterical symptoms (except for the blindness), and there was nothing suggestive of hysteria in his previous history. A sample of the liquor he had been drinking was obtained, and examination of this was negative for wood alcohol.

Without difficulty the patient was placed in a hypnotic state, and it was explained to him that in the course of a few minutes he would be able to see. The patient then looked up and was surprised to find that he could see the overhead light in the sick bay. A moment

later he looked around and saw the various objects about him. In the several following months that we were able to observe this man there was no return of the trouble.

Case 2 is that of a patient whom, fortunately, I can present to you. Aside from his recent episode of blindness his history indicates that he has always been a normal, healthy person, and there appears to be nothing about his present or past suggestive of hysteria.

He is an electrician, 34 years old. He progressed normally through the grade school in Chicago and then successfully completed technical courses in a Chicago high school, since which time he has been steadily employed in electric-sign work.

He enlisted in the Marine Corps in 1917, served at Quantico, and on board the U. S. S. *Utah*, and was honorably discharged in 1919, after two years of service, marked by a perfectly clear record and no sick days.

He was married in October, 1919, and has enjoyed a pleasant home life devoid of any strife or worries, except perhaps the financial anxieties from which most of us suffer.

On November 20, 1930, following a tooth extraction, he drank about a half pint of gin, which he hoped would have a sedative effect. About an hour later, shortly after arriving home, he very suddenly became blind, and concluded that he had drunk some wood alcohol. He had frequently worried, while drinking, about the possibility of wood-alcohol poisoning.

Two days later I saw him at Gallinger Hospital. He was totally blind, not being able to distinguish even light and dark. Examination of the eye grounds revealed no pathology, and the history led me to conclude that the case was one of psychogenic amblyopia.

The following day his condition was unchanged, and I decided to try some psychotherapy on him. He was very easily placed in a hypnotic state and then told that at the count of 10 he would be able to see. At the count of 10 he did not fail me, and he has enjoyed normal vision since that moment.

This form of therapy, which fills the entire bag of tricks of the Christian Scientist and chiropractor and other cultists, might well be put to more frequent use by ourselves—and would be if we recognized more often the psychogenic nature of many conditions.

REFERENCE

(1) Derby, G. S.: Ocular Neuroses: An Important Cause of So-Called Eye Strain. *Jour. Am. Med. Assn.*, 95: 913, Sept. 27, 1930.

Discussion by Capt. D. G. SUTTON, Medical Corps, United States Navy

Doctor Ebert has presented a very interesting and instructive paper. Such cases are always very interesting to me from the standpoint of differential diagnosis, and to my mind they very strongly illustrate the necessity for every

physician to obtain a working knowledge of basic psychology in relation to medicine and surgery. The Naval Medical School here affords the opportunity for those taking the course to obtain slight knowledge of the essential groundwork in normal psychology as well as psychopathology, but naturally in so short a time a great deal can not be accomplished. If, however, those in the class will continue to read those phases of the specialty that especially interest them they can in a short time accumulate sufficient information to assist them in problems of all kinds having a bearing on differential diagnosis involving a decision as to functional or organic disease.

In our larger naval hospitals to-day the young medical officer is afforded the opportunity to rotate in the various services so that within a few years they have obtained a well rounded out clinical experience, especially in internal medicine and surgery. Unfortunately, every one can not obtain duty in relation to the N. P. service unless they especially request it. I want to take this opportunity to suggest that every one obtain some N. P. experience where possible. Within the past few years I have been associated with men who were outstanding internists but who frankly said that when they reached the neutral ground where a decision had to be made between a neurosis on the one hand and an organic stomach or heart condition on the other, they were not competent to judge. These same men, after three months on a good N. P. service, returned to internal medicine with the feeling that their time had been well used.

But that may all be aside from the point. What I wanted to stress was the fact that Doctor Ebert arrived at his diagnosis and was able to successfully treat the patients because he not only quickly recognized the situation but obtained a cure because of his ability to take the proper steps at the right time. Another physician less familiar with the psychology of the situation might have put off treatment or made some undiplomatic remark that would have tended to postpone recovery or made such a result impossible.

The French, during the World War, accentuated the great advantage of immediate treatment of neurotics. The British were hospitalizing all conversion neuroses and sending them back home, with the result that their percentage of recoveries was very low. The French, on the other hand, established hospitals within the sound of artillery and there treated such patients with a very high percentage of recoveries. They told their patients that they were very sick individuals, but that examination unquestionably demonstrated the fact that they could be and would be cured. Following this they kept them in the hospital for a period of weeks undergoing a course of indoctrination at the hands of trained nurses and attendants. During this period of indoctrination they saw other patients, having the same illness that they had, leave the hospital entirely well. When their time came for treatment, each patient was anxious to be treated and many of them asked to be taken out of turn. As a result, when the time came the patients had confidence in the physician and felt that they, too, would be well. In connection with this it is interesting to recall that the physicians in charge made it a rule never to allow any patient to cease treatment without either a full recovery or marked improvement, although the treatment in some cases took hours. As a result, neurotic aphonias, amblyopias, monoplegias, and circumscribed anesthesias were cleared up without residuals and returned to the lines.

Where a physician is competent to employ hypnotism in one of its degrees, it, of course, can be used, as in these cases; but suggestion and other constructive measures obtain the same results. The essential factor is an understanding of the problem.

In so far as I know, the illness which is the subject of the paper, is generally considered to be classified under the neuroses. The term psychogenic expresses it very well in that it indicates a functional origin, but all such conditions are considered as a form of hysteria, and I can see no object in coining a new expression, especially when it may lead to misunderstanding. Amblyopia of this type is frankly a conversion neurosis in the physical field while compulsions; obsessions, etc., are found in the mental sphere. All have the same psychological value.

Discussion by LIEUT. C. A. SWANSON, Medical Corps,
United States Navy

I saw the case presented this afternoon at a local hospital in company with Doctor Ebert. The patient had been in the hospital for two days. In conversing with the resident physician I was informed that the tentative diagnosis was wood alcoholism with resultant blindness. An ophthalmoscopic examination had not been done.

A brief perusal of the history showed an amaurosis of complete and immediate onset following several drinks of gin. There was not even light perception. Further examination showed a hemianesthesia and corneal anesthesia. The ophthalmoscopic light reflex was present. With the above information it is obvious that there was not an optic neuritis due to wood alcohol. An amaurosis of complete and immediate onset militates against any such diagnosis. An amblyopia caused by wood alcohol is of a more gradual onset and not immediate and complete. Further, the fundus picture in acute wood alcohol poisoning would show a papilledema.

Vision was completely restored by hypnosis. Subsequent examination showed normal perimetric findings as to form and color fields. There was 0.50 diopter of hyperopic astigmatism in each eye.

Amaurosis may occur in several disease entities without demonstrable fundus changes. It may not be amiss to briefly mention a few.

1. Uremic amaurosis: Occasionally blindness occurs within a few hours in uremia. It may be complete. The fundus may be negative simultaneously with the visual disturbances. Other signs of uremia become manifest, such as vomiting, dyspnea, and convulsions. This, together with blood chemistry findings, makes the diagnosis.

2. Scintillating scotoma: This is seen at times in migraine. It is often referred to in the literature as migraine oculaire. The patient perceives a dazzling of light before the eyes until vision is almost gone. The attack is transient. The fundus is normal. The etiology is described as an angio-neurotic disturbance in connection with the optic tracts.

3. Hysteria: Amblyopia or amaurosis is merely one of the protean manifestations of this disease. Repeated examination in hysterical amblyopia will show inconstant perimetric findings. The fundus will be normal in this disease. There no doubt would be other signs of hysteria as hemianesthesia, etc., such as this case presented.

4. Complete bilateral simulated blindness: This would tax one's diagnostic acumen. Some underlying motive as evasion of military duty or damage suit may be elicited. Bilateral complete simulated blindness must be rare. I have yet to hear of a case related by any doctor. With complete simulated unilateral blindness detection is not so difficult. These methods are well described in the literature and need no explanation at this time.

In a case of toxic amblyopia, such as caused by chronic alcohol and tobacco poisoning, it may be difficult to see any fundus changes. Perimetric study, however, will show a color scotoma and in the more advanced cases an absolute scotoma of a horizontal form from the macula lutea to the blind spot. The impairment is in the papillo-macular bundle.

In all cases of amblyopia, an accurate history and a general physical examination coupled with a thorough refractive, ophthalmoscopic and perimeter study is necessary for correct diagnosis.

A CASE OF HEART BLOCK WITH STOKES-ADAMS'S SYNDROME

By A. S. JUDY, Lieutenant Commander, Medical Corps, United States Navy, and F. E. McALANEY, Pharmacist's Mate, First Class, United States Navy

The following case is presented because of the rarity with which heart block with Stokes-Adams's syndrome is seen in the officer and enlisted personnel of the naval service.

The patient, a chief gunner's mate, age 35, and single, was admitted to the Great Lakes Naval Hospital on July 2, 1930. His chief complaint was "dizziness and fainting spells."

The history obtained on admittance was as follows:

The patient felt well until July 1, 1930, when he had a "dizzy spell" lasting a few seconds. He did not lose consciousness or fall. He reported to the sick bay as soon as possible and was sent to the hospital for electrocardiographic examination.

The "dizzy spells" continued during the day and the patient thinks that they appeared as frequently as every half hour. He did not sleep well during the night because he was nervous and frightened by his condition. He felt the "dizzy spells" continue during the night.

Upon arising in the morning, the "dizzy spells" persisted and seemed to be more severe and more frequent. He reported to the sick bay and was put to bed. About 2 p. m., while standing alongside his bed, he lost consciousness and was transferred to the naval hospital.

Previous attacks.—In 1926, while on the Asiatic station, he had "trouble with his heart" and was sent to the United States naval hospital at Canacao for a period of six weeks. He states that when admitted to the hospital his heart was beating slowly, but very forcibly, and raised the bed clothes covering his chest. He felt weak and was short of breath on exertion, but had no "dizzy spells."

About six weeks before this he had a severe attack of dysentery. His right foot and ankle swelled but were not painful. Several weeks later his left foot and ankle swelled for three or four days but were not painful. He was told that his heart was "enlarged and pushed to the left." Upon returning to duty he had no further attacks until the present illness.

Upon trying to reenlist in June, 1927, the medical officer told him that he had "heart trouble," but did not tell him the diagnosis.

Previous illnesses.—Measles, mumps, meningitis at the age of two years, smallpox at the age of six years, dysentery in 1926, and frequent attacks of tonsillitis. No history of acute rheumatic fever, chorea or syphilis. The patient had played basket ball on the ship's team for a period of three years.

Otherwise had performed a moderate amount of physical labor and exercise. Tobacco, tea, and coffee used in moderation.

Family history.—Father dead, age 65, "peritonitis." Mother living, age 60. Has high blood pressure. Two brothers living and well. Two sisters living and well. No history of tuberculosis, heart trouble, or cancer in the family.

Electrocardiograph findings.—The first tracing was taken on July 1, 1930, and before the patient was transferred to the hospital: Rate, 75 and regular; P waves, upright in all leads; PR interval, 0.18 second. S wave is somewhat notched in leads 1 and 2. Tall R in lead 1; deep S in lead 3; T waves, upright in all leads; impression, rather marked left preponderance.

NOTE.—Breathing exercise was given and the only thing noted was that voltage was decreased and very slight sinus arrhythmia brought about. Regular exercise (hopping 20 times on each foot) was not given because of the patient's condition.

The patient was admitted to the hospital on July 2, 1930, in a markedly weakened condition, with pulse of 32 and showing frequent attacks of Stokes-Adams's syndrome. The tracing shows an auricular rate of 80 and ventricular rate of 30; complete dissociation of auricles and ventricles is present.

Electrocardiograph report, July 2, 1930.—Rate, auricular—approximately 80; ventricular—approximately 30; Q. R. S. 0.12 second. S waves notched in leads 1 and 2; T waves, upright in leads 1 and 2; markedly inverted in lead 3; impression, complete heart block.

Another electrocardiogram was taken the afternoon following admission, and the patient presented a typical case of complete heart block with Stokes-Adams's syndrome. During this period the ventricular rate dropped to about eight per minute.

Electrocardiogram report, July 3, 1930.—Rate, auricular—approximately 80; ventricular—approximately 30; Q. R. S. occupies 0.12 second. There is notching of the R waves in leads 1 and 2 and slurring of R wave in lead 3; T waves, upright in leads 1 and 2; markedly inverted in lead 3; impression, complete heart block accompanied by Stokes-Adams's syndrome.

On July 18, 1930, another electrocardiogram was taken. (Patient had been at complete rest in bed—no exertion whatever—wheeled to electrocardiograph room on cart.)

Electrocardiograph findings, July 18, 1930.—Rate, 75 and regular; P waves, upright in all leads; PR interval, 0.22 second (upper limit of normal); Q. R. S. occupies 0.08 second. Tall R in lead 1; deep S in lead 3; T waves, upright in all leads; impression, moderate left preponderance. Partial heart block.

A tracing taken on July 25, 1930, was practically the same as tracing of July 18, 1930.

Beginning August 5, 1930, the patient was allowed a recreation period in the park for from two to three hours each afternoon. The electrocardiogram tracing was the same as the two previous tracings, but the PR interval distance was not as great (0.16 second).

By September 8, 1930, the patient was up and about, showing a normal pulse rate, and performing an average amount of exercise without discomfort or any symptoms.

Although a case of this sort would ordinarily call for a survey from the service, the patient was allowed to return to duty on September 16 because he lacked a small amount of service to complete the necessary 16 years for retirement benefits, and it was known that his duties would be of a very light nature.

To date we have heard of no recurrence of his trouble.

UNDULANT FEVER

By H. F. LAWRENCE, Captain, Medical Corps, United States Navy

A case of undulant fever was admitted to the United States naval hospital, San Diego, Calif., on January 25, 1930, from the United States naval training station. The history and record of the case is as follows:

C. S. L., apprentice seaman, age 19 years.

Family history: Father living and well. Mother has asthma. One brother has asthma. Another brother had undulant fever during June and July, 1929, the diagnosis having been made at the Mayo Clinic.

Past history: Had measles and chicken pox during childhood. Had pneumonia six years ago. Has not had malaria or typhoid fever. Had tonsillectomy during childhood. Denies any venereal infection. He enlisted in the Navy 75 days prior to being taken ill. Before his enlistment, he lived in South Dakota and had not been out of the North Central States. After enlistment he was stationed at San Diego.

Present illness: The onset was on January 22 following a "cold in head." He turned in early in the evening feeling that he had a fever. Shortly after going to bed, he was stricken with a severe chill which lasted two hours and was followed by profuse sweating. He continued to have fever, chills, and sweating every evening and occasionally during the day. Headache was severe from the onset. When admitted to the hospital, his signs and symptoms were as follows:

Temperature, 104°; pulse, 96; respiration, 22. Headache severe; coughed occasionally and expectorated scanty mucopurulent sputum tinged with bright red blood.

Physical examination.—A well-developed and well-nourished white man. He appeared dull and apathetic but not acutely ill.

Head and neck: Symmetrical; no scars.

Ears and nose normal.

Eyes: Pupils equal; reacted to light and accommodation.

Teeth in good condition. Tonsils removed.

Throat not inflamed. Neck not stiffened.

Chest: Expansion good and equal on the two sides.

Lungs: No impairment of fremitus or resonance. There were numerous crackling râles over both lungs posteriorly, most marked over the upper left lobe.

Heart: Normal rhythm; no murmurs.

Abdomen: No masses or tenderness; spleen not enlarged.

Genito-urinary: Patient wore a suspensory bandage. He said he had had pain in testicles for four weeks; no swelling at time of examination.

Extremities: No abnormal findings.

Skin: No abnormal findings.

Reflexes: Skin and tendon reflexes normal. Kernig's and Babinski's signs negative.

Laboratory reports.—Urine: No abnormal findings on several examinations.

Sputum: No tubercle bacilli found on numerous examinations.

Cerebrospinal fluid: Was not under increased pressure; Kahn negative; 3 cells per cubic centimeter; Pandy's test negative; dextrose, 63 milligrams per 100 cubic centimeter; no microorganisms found; no growth on culture-media in 5 days.

Blood: Kahn test negative; no malarial organisms found on several examinations. Leucocyte count averaged 5,000. The polymorphonuclears and the lymphocytes were approximately equal in numbers. Erythrocytes, 4,670,000.

On February 4, the laboratory report showed agglutination for *B. Paratyphosus* A or B. Agglutination with *B. Typhosus* in all dilutions up to and including 1-512; no higher dilution made.

(NOTE.—The patient had had typhoid vaccine administered two months prior to illness. Agglutination with *B. Melitensis* in all dilutions up to and including 1-100.)

On February 11, the laboratory report showed complete *B. Melitensis* agglutination in a dilution of 1-1,600, partial agglutination in 1-3,200, and a trace in a dilution of 1-6,400. Agglutination against *B. Tularemia*, *B. Coli*, *B. Pullorum* antigens gave negative results.

On February 26, the agglutination of the patient's serum against *B. Melitensis* was the same as on February 11.

On March 6, the serum showed positive agglutination with *B. Abortus* antigen in dilutions up to 1-1,600.

Several attempts were made to grow the *B. Melitensis* from the urine and blood but without success.

Feces: No ova or parasites found. No microorganisms of the typhoid or dysentery group grew on culture-media.

X-ray plate of the chest made on February 1, showed an acute respiratory infection. On February 10, the X-ray findings were practically the same as on the first examination. There was no evidence of miliary tuberculosis.

Sensitization tuberculosis test done on February 4 was negative.

Progress of the disease.—During the course of the disease, he perspired profusely. On numerous occasions, he complained of pain in his joints and sometimes of general body pains.

The fever was of the septic type. On January 26, the day of his admission to the hospital, his temperature was 104° F. Until February 12, the daily rise in temperature was to 103-105, the temperature falling to normal sometime during the day. From February 12 to March 12, the temperature gradually became normal and remained normal except for occasional variations from 97-99.4° until June 28. At this time he had a daily rise of fever to 100°, lasting four weeks.

During the first five weeks of the febrile stage of the disease, the pulse ranged from 80 to 110, not differing from the usual increase in pulse rate accompanying most febrile diseases. On March 5, when the temperature had nearly reached normal, the pulse rate was recorded as 130. During the remainder of March and during April, May and June, the pulse rate averaged 120. During July, the pulse rate average was 110. For a few days prior to his discharge from the service on August 28, his pulse rate remained below 100.

The blood pressure during the period of pulse acceleration was recorded as 140 systolic and 96 diastolic. The basal metabolism rate was plus two. His extremities were usually cold, or bluish hue, and perspired freely. The electrocardiogram of March 10 showed sinus tachycardia, rate 150; otherwise negative. The electrocardiogram of April 22 showed a moderate sinus tachycardia, rate 116; otherwise negative. The heart was not enlarged and there were no heart murmurs.

COMMENT

When the symptoms and the agglutination test indicated that the patient had undulant fever, he was questioned with the view of determining, if possible, the source of the infection.

He never drank goat's milk and did not use cow's milk except occasionally on cereal in the morning. He had nothing to do with slaughtering animals. Before enlisting in the Navy, he worked on a farm and had the care of cattle and hogs. He stated that some of the sows aborted, but he had not the care of these animals for at least nine months prior to his illness.

The clinical course of the disease was not sufficiently distinctive to make a positive diagnosis without the aid of the agglutination test.

The incubation period of undulant fever is given as 14 days. This patient was away from his home for 75 days before he felt ill. It is reasonable to conclude that he was frequently exposed to undulant fever at his home. One of his brothers living on the same farm contracted the disease six months previously.

The possibility of this patient's fever being due to a pulmonary infection and the agglutination reaction due to a prior infection appears improbable as the agglutination test for *B. Melitensis* on February 4 was positive in dilutions up to and including 1-100 and on February 11 positive in the 1-1,600 dilution. The agglutinins were therefore increasing as the disease progressed. We believe he received his infection in San Diego.

He was discharged from the naval service on August 28, 1930, the principal cause of disability being tachycardia.

Prevalence of undulant fever.—That undulant fever is widespread in the United States is shown by the Public Health reports and by a perusal of the medical journals.

The United States Public Health Service reports 367 cases occurring in the United States in 1928. The disease is not listed as reportable in all States, and it can not be doubted that many more escaped record.

Walter M. Simpson and Eunice Frazier (1) report that 63 cases of undulant fever have been discovered in and about Dayton, Ohio, during the year prior to their investigation.

Giordano and Sensenich (2) reported 35 cases infected with *Brucella Abortus* in South Bend, Ind.

Farber and Mathews (3) have reported an epidemic of undulant fever affecting 25 students and 1 laundress at Earlhorn College, Richmond, Ind.

Caville and Carpenter (4) have reported eight cases of undulant fever at Ithaca, N. Y.

Kern (5) has investigated 36 cases of undulant fever occurring in the United States.

Orr and Huddleston (6) reviewed 36 cases of undulant fever reported in Michigan.

An extensive serological study of human serums, cattle, hog, and goat serums regarding agglutination with *B. Melitensis* and *B. Abortus* has been in progress in this country for several years.

Dr. R. A. Whiting, Zoological Research Hospital, San Diego, Calif., reports on the incidence of abortus infection in San Diego County:

Agglutination tests of 1,017 samples of human sera in San Diego City show that 37 or 3.6 per cent react in some degree to *B. Abortus* (Bang) antigen. The reactions varied from incomplete agglutination at 1 to 20 dilution, up to complete agglutination at 1-2,400 dilution. Eleven of the reactions, or practically 30 per cent, were in dilutions of 1 to 100 or higher, and are considered as definite positive reactions.

Seven of these were females and four were males. Their ages varied from 5 to 60 years; the majority were adults who had not had direct contact with cattle or swine.

Blood samples of 523 cattle from 21 herds gave an average incidence of about 20 per cent. Seven herds were free of the infection. In every case efforts are being made to control and eradicate the disease.

Goat specimens so far have proven negative to the tests.

A few tests of breeding swine show more than 20 per cent of infection.

That undulant fever seldom occurs among those on the active list of the Navy is shown by the annual reports of the Surgeon General of the Navy. Only one case occurred during the years 1927, 1928, and 1929. In considering the widespread prevalence of undulant fever it might appear that the Navy is not reporting all its cases. From recent studies it is quite certain that many communities in the United States have failed to recognize undulant fever. Laboratory tests are necessary for confirmation. Agglutination in dilutions below 1-80 is not usually considered diagnostic. It is notably difficult to obtain blood cultures in some cases of undulant fever. Huddleston and Giordano (7) have emphasized the fact that a considerable percentage of patients who have suffered from the disease fail also to show agglutinins in their blood serum against any strain of the melitensis organisms. These patients, however, have been sensitized to the protein of the organism or the products of its growth and react positively to intradermal injections of bacterial suspensions or broth filtrates of abortus cultures. It is necessary, therefore, in doubtful cases to test the serum for agglutinins repeatedly, to culture the blood repeatedly, and, lastly, to perform intradermal skin-sensitization tests.

Dr. Alfred S. Giordano, South Bend, Ind., has furnished this hospital with a saline suspension, heat-killed culture of *Brucella abortus* (Clark strain) to use for skin sensitization tests.

Dr. I. F. Huddleston, East Lansing, Mich., has furnished this hospital with a bacteria-free broth filtrate of cultures of *Brucella abortus*, also to be used for intradermal tests.

It may appear that this hospital is placing undue emphasis on the diagnosis of undulant fever, considering the small incidence of the disease and that all milk furnished the Navy on contract is pasteurized. There have been, however, several patients in this hospital during the past year who had a continued fever without leucocytosis, and who did not have typhoid fever, paratyphoid fever, malaria, or tuberculosis. Tentative diagnoses of undulant fever were made in these cases and it became necessary to state positively if they were or were not undulant fever.

REFERENCES

- (1) Simpson, W. M., and Frazier, E.: Undulant fever; report of 63 cases occurring in and about Dayton, Ohio, J. A. M. A. 93:1958-1963. December 21, 1929.
- (2) Giordano, A. S., and Sensenich, R. L.: *Brucella abortus* infection in man; clinical analysis of 35 cases. J. Lab. & Clin. Med. 15:421-436, February, 1930.
- (3) Farbar, M. E., and Mathews, F. P.: Epidemic of undulant fever with study of associated milk supply. Ann. Int. Med. 2:875-880, March, 1929.
- (4) Coville, L., and Carpenter, C. M.: Undulant (Malta) fever (A). New York State J. Med. 29:72-74, January 15, 1929.
- (5) Kern, R. A.: Clinical aspects of *Brucella melitensis* var. *abortus* infection in man; report of first cases recognized in Pennsylvania. Am. J. M. Sc. 176:405-430, September, 1928.
- (6) Orr, P. F., and Huddleson, I. F.: Epidemiological study of undulant fever in Michigan. Am. J. Pub. Health, 17:1242-1247, December, 1927.
- (7) Huddleson, I. F., and Johnson, H. W.: Brucellosis; significance of *Brucella* agglutinins in blood of veterinarians. J. A. M. A. 94:1905-1907, June 14, 1930.

RETROPERITONEAL RETICULUM CELL SARCOMA

REPORT OF A CASE

By W. H. FUNK, Lieutenant Commander, Medical Corps, United States Navy, and O. W. WICKSTROM, Lieutenant (Junior Grade), Medical Corps, United States Navy

L. G. R.—V. B. P., aged 50, was admitted to the United States naval hospital, Portsmouth, N. H., on November 25, 1930, complaining of pain in left lower back and left leg. He gave a history of weakness and loss of weight during the past two years. During the six months previous to admission he had had frequent attacks of left sciatica. For the last three weeks pain was so severe that he had to remain in bed. Admitted to the hospital as a stretcher case.

Physical examination showed emaciation, dental caries, chronically diseased tonsils, marked tenderness over fourth and fifth lumbar vertebræ, and inability to flex left thigh. Reflexes and sensation to touch and pain were normal and equal in both legs. Kahn, urine, and sputum were negative. Red-blood count 3,850,000 to 4,440,000; white blood count 6,000 to 13,000, with 72 to 90 per cent polymorphonuclears. The X ray showed erosion of the transverse and spinous processes of the fourth and fifth lumbar vertebræ suggestive of metastatic malignancy.

Patient had a daily septic temperature, gradually weakened, and died on December 29, 1930. The last few days he showed signs of meningeal irritation, with coma and rigidity of the neck.

Autopsy showed a firm homogeneous white mass about 4 centimeters in diameter at the upper pole of the left kidney. All the pelvic and retroperitoneal lymph glands were enlarged, discrete, and filled with tumor tissue. Both kidneys showed multiple small masses of white tumor tissue. There were also metastases in the pancreas and lungs. A pathological fracture of the fourth rib anteriorly was found. Masses of tumor tissue were also found extending into and occupying parts of the fourth and fifth lumbar vertebræ. The head and spinal column were not examined.

Specimens of these growths were forwarded to the Naval Medical School for histopathological diagnosis. The tumor tissue was described as consisting of oval or polyhedral cells having a fair amount of cytoplasm with a large oval irregular nucleus resembling anaplastic reticulum cells. Many mitotic figures were seen. Diagnosis: Sarcoma, reticulum cell type, primary in the abdominal lymph nodes with metastases to lungs, ribs, pancreas, kidneys, and vertebræ.

This case was very puzzling from a diagnostic standpoint. A diagnosis of malignant disease with metastases was made from the X-ray pictures of the lumbar vertebræ, but the primary source of the tumor could not be found during life. The usual sources of malignant disease giving bony metastases, such as prostate, thyroid, kidney, and breast were investigated repeatedly, but without success. No tumor mass could be palpated.

ANAPHYLACTIC SHOCK ACCOMPANYING BENIGN TERTIAN MALARIA

By G. C. THOMAS, Captain, Medical Corps, United States Navy, and G. B. RIDOUT, Lieutenant (Junior Grade), Medical Corps, United States Navy

An unusual and apparently rare manifestation of the malarial paroxysm was observed in a patient on board the U. S. S. *Texas*. As a careful investigation of all available literature on the subject, and conversations with naval medical officers who have seen a great many cases of malarial fever failed to reveal a similar clinical picture, it is thought worth while to present the following case history:

G. W. S., a seaman, age 18 years, was born in Illinois, and enlisted in St. Louis in September, 1930. His family history reveals no pertinent facts, and he has had no serious illness at any time. There is no instance of hay fever, asthma, nor hypersusceptibility to food or drugs, either in his family history or his own. After enlistment, the patient was sent to the naval training station, Great Lakes, Ill., and during his stay there he received the customary cow pox vaccination and typhoid prophylaxis. He reported on board the U. S. S. *Texas* in New York, December 12, 1930, and until that time had spent all his life in the Middle Western States. The *Texas* left New York on January 8 and sailed to Guantanamo Bay, Cuba, with a stop-over of three days at Hampton Roads, Va., arriving at Guantanamo on January 16, 1931. The patient states that he had not been ashore since joining the ship at New York. On January 22, he appeared at morning sick call with what

appeared to be a recurrence of an attack of acute catarrhal fever, from which he had suffered four days' illness while the ship was in New York. On admission, he stated that he had a severe chill early in the morning, followed by sweating and feverishness.

Physical examination: Temperature, 104; pulse, 100; respiration, 20. Throat appeared reddened. A few moist râles were heard over the larger bronchi. White blood count, 8,900, with normal differential count, and no changes in the red cells.

His condition on admission seemed quite similar to that of many others suffering from the prevalent epidemic of catarrhal fever on the ship. His treatment consisted of mistura glycyrrhiza compound, 4 cubic centimeters three times daily, with acetyl salicylic acid, gram 0.3 every four hours, and a nasal spray of 5 per cent silvol three times daily. On January 24 the patient had a severe chill. This was followed by a rapid rise in temperature and a suddenly appearing severe anaphylactic reaction, with giant urticarial wheals covering the entire body and extremities, and considerable œdema of the glottis. Both lungs were filled with moist râles, and breathing became dyspnoeic, with cyanosis of the face and hands. Patient was unable to speak because of the œdema of the glottis. The pupils were widely dilated, but there was no apparent evidence of cerebral involvement. Temperature, 103.8; pulse, 140 and very weak. Respirations, 40 per minute. Adrenalin administered, with rapid improvement in condition. Sodium bicarbonate given in large quantities by mouth. The œdema and urticaria had entirely disappeared within an hour after the onset of the attack. A blood smear taken at the time of his chill showed an enormous number of benign tertian malarial parasites. Quinine therapy was instituted, 0.8 gram every four hours, by mouth. All other medication was suspended.

On January 25 he felt very well. Temperature, pulse, and respirations were normal. Quinine continued. January 26: Patient had another severe chill, with fever and marked anaphylactic reaction. Temperature 106, pulse 160 and very weak and thready in character. Respirations 34 per minute, and dyspnoeic in character. Both lungs filled with many moist râles. Urticaria and œdema of the glottis reappeared, and patient seemed dangerously ill. Response to adrenalin was rapid, however, and improvement was complete within two hours. Blood smears were again positive for benign tertian malaria. Quinine continued. January 27: Patient felt very well, with subnormal temperature, normal pulse and respiration, and no pulmonary manifestations. January 30: apparently normal except for slight herpes labialis. Quinine continued, and patient returned to duty.

This is the first occurrence of malaria in many months aboard the *Texas*, and it seems reasonable to assume that the patient had a latent infection, undoubtedly contracted before joining the ship in New York, and lighted up by the sharp climatic change. The fact that he had an anaphylactic reaction indicates a previous infection, with formation of antibodies in his blood stream. It is difficult to attribute his anaphylactic reaction to any agency other than the toxin of the plasmodium malariae, as it occurred after withdrawal of medication, and in spite of close supervision of his food ingestion. Then, too, each reaction was perfectly synchronous with the outpouring of the parasites from the red blood cells, as demonstrated by the blood smears taken at the time of the chill.

An interesting point here was the persistence of large numbers of parasites in the blood after the third paroxysm, despite the fact that the patient received 8 grams of quinine sulphate between the second and third chill. The drug was given in tablet form and it may be that its assimilation was much more imperfect in this form than it would have been in capsule form.

A CASE OF CALCULUS OF KIDNEY COMPLICATED BY PISTOL BULLET

By L. B. MARSHALL, Lieutenant Commander, Medical Corps, United States Navy

T. P. O'H., Veterans' Bureau patient, age 31, entered this hospital October 24, 1930, with diagnosis of pyelitis.

Complaint on entry: (1) Dull ache across small of back; (2) weakness, tires easily, poor appetite.

Present illness: Aching across back has been present off and on for three years, but has grown worse lately. The back-ache can be brought on or made worse by bending over or attempting to lift objects and will last several hours. No frequency of urination or hematuria.

Past history: Is exceedingly interesting. In 1914 patient fell from balcony and landed on his abdomen across a saw horse. Peritonitis developed and abdomen was opened and drained. Hospitalized for six weeks. In 1917 an appendectomy was done, following perforation of appendix. Three days later he developed meningitis and was hospitalized for three months, with complete recovery. In 1918, in action in France, he received two bullet wounds in his left side. He urinated blood at this time, but this soon cleared up and he was invalided to the States for further treatment and sent to Camp Taylor, Ky. There he was placed on light detail and was injured by a falling box of ammunition, which struck him on left side.

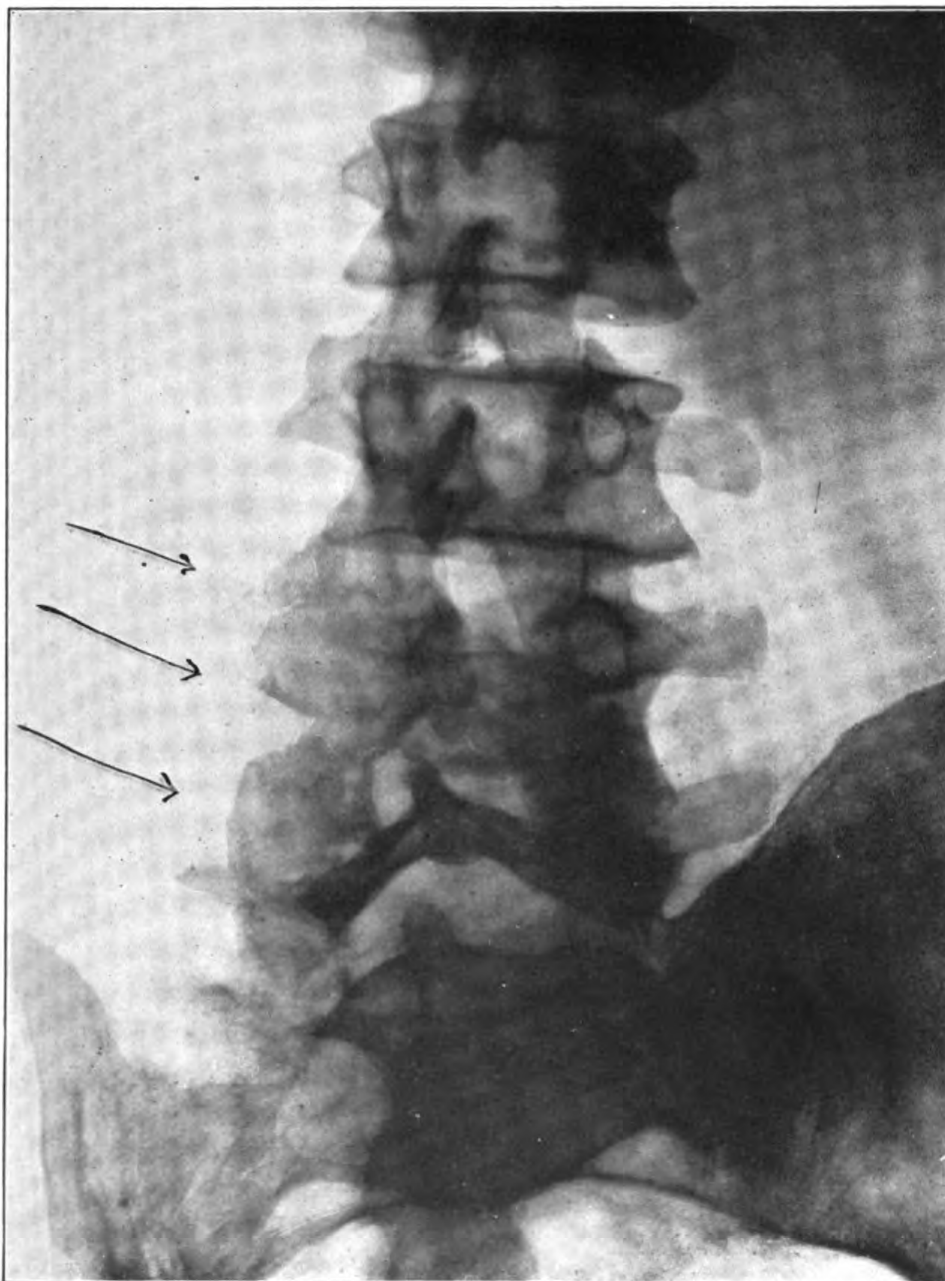
Five days later a large quantity of pus was passed with each urination. He was then transferred to Fort Sheridan, Ill., and there the left kidney, one bullet, and three small stones were removed, according to his statement. He was hospitalized for six months and discharged when improved.

Since 1920 he has been drawing \$40 a month compensation for his disability. In 1921 a ventral hernia developed which was repaired. In 1927 he developed this severe backache and entered Cook County Hospital, where he was cystoscoped and X rayed and the second bullet found. A diagnosis of chronic cystitis and pyelitis was made and he was discharged. Venereal disease denied.

Physical examination revealed no gross pathology except the scars of his several operations.

On October 28, 1930, he was cystoscoped, and since his history showed a left nephrectomy, a right pyelogram only was made.

Imagine our surprise when the X ray showed a definite shadow of the left kidney, containing in region of upper pelvis a large irregular calcified mass, 5 by 3 centimeters, and just below this mass, in the same plane, a .45-caliber pistol bullet. In one plate made previously the tip of the bullet pointed medially; in this plate the bullet points laterally. He was again cystoscoped on November 4, 1930, and left kidney investigated. Urine could be seen spurt-ing from the ureter. A No. 5 catheter passed up easily with good flow of urine. P. S. P. 5½ minutes, fair color. Pyelogram made.



472-1

RETICULUM CELL SARCOMA



LARGE CALCULUS AND BULLET IN RENAL PELVIS

472-2

He was studied further and on November 21 a left nephrolithotomy was done. The irregular calculus was easily removed through the pelvis and lying in the lower major calyx the bullet could be felt. This was removed with little difficulty. The bullet, after removal, was apparently a lead bullet of about .38 caliber.

The patient convalesced uneventfully.

It is rather unusual to find in the kidney foreign bodies which have entered from the outside. In this case the bullet had been in the kidney for about 12 years and was probably the exciting cause of the calculus. Considering the size of the stone and the pressure of the bullet in the kidney, the kidney was in good condition, and was not removed.

NAVAL RESERVE

APPOINTMENTS

Name	Rank	Appointed
Eaton, Ernest Risley.....	Lieutenant commander, MC-V (S).....	Feb. 18, 1931
Gilmore, Robert Owens.....	Lieutenant, MC-V (S).....	Jan. 9, 1931
Glickman, Alfred Myron.....	Lieutenant (junior grade), MC-V (G).....	Mar. 12, 1931
King, Connie Holt.....	Lieutenant (junior grade), MC-V (G).....	Jan. 29, 1931
Pearce, James Hezekiah.....	Lieutenant (junior grade), MC-V (G).....	Feb. 5, 1931
Stoops, William Arthur.....	Lieutenant commander, MC-V (G).....	Mar. 10, 1931
Vaughan, Roland Gray.....	Lieutenant (junior grade), MC-V (G).....	Jan. 12, 1931
Wilson, Marcus Bryed.....	Lieutenant commander, MC-V (S).....	Mar. 9, 1931

PROMOTIONS

Name	From—	To—
Kornblut, Alfred.....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.

NOTES AND COMMENTS

NEW STANDARD BOOK LIST FOR FISCAL YEAR 1932

Effective July 1, 1931, a new standard list of books will form the supply table list for all Medical Department activities except hospitals. Requisitions from hospitals, as in the past, will not be limited to any particular list.

The new list appears below. Asterisk indicates changes made since the list published in the July, 1930, BULLETIN. Requisitions for these new items may now be submitted in order to bring the Medical Department libraries up to the present standard.

The bureau always welcomes suggestions from medical officers as to the desirability of retaining any of these books on the list or of replacing them by others.

Textbook of Anatomy, Cunningham, 5th edition.

Practical Bacteriology, Blood Work and Animal Parasitology, Stitt, 8th edition.

Chemistry, Inorganic Pharmaceutical, Rogers, 1930.

Oral Anesthesia, Thomas, 2d edition.

Dental Histology and Embryology, Noyes, 4th edition.

Dental Formulary, Prinz, 4th edition.

*Bacterial Infection, Appleton, 1925.

Modern Dental Materia Medica, Pharmacology, and Therapeutics, Buckley, 5th edition.

Dental Pathology and Therapeutics, Buchard and Ingles, 7th edition.

*Oral Radiography, Simpson, 1928.

Diseases of the Mouth, Mead, 4th edition.

Dental Dictionary, Ottofy, 1923.

*Operative Dentistry, McGhee, 1930.

*Periodontal Diseases, Merritt, 1930.

*Prosthetic Dentistry, Nichols, 1930.

Medical Diagnosis for the Student and Practitioner, Green, 6th edition.

American Illustrated Medical Dictionary, Dorland, 15th edition.

*Diseases of the Skin, Andrews, 1930.

Dispensatory, Wood and La Mall, 21st edition.

Drill Book for Hospital Corps, United States Navy, 1920.

The Nose, Throat, and Ear, and Their Diseases, Jackson and Coates, 1929.

Food Analysis, Typical Methods and the Interpretations of Results, Woodman, 2d edition.

Fractures and Dislocations, Speed, 2d edition.

Urology, Eisendrath and Rolnick, 1930.

*Gonococcal Urethritis in the Male, Pelouze, 1928.

Hospital Corps Handbook, United States Navy, 1930.
Naval Hygiene, Pryor, 1918.
Manual of the Medical Department, United States Navy, 1927.
Medical Compend for Commanders of Naval Vessels, 1923.
*Textbook of Medicine, Cecil, 1930.
National Formulary, 5th edition.
Diseases of the Nervous System, Jelliffe and White, 5th edition.
Practical Nursing, Maxwell and Pope, 4th edition.
Manual of the Diseases of the Eye, May, 13th edition.
Pharmacopoeia of the United States, 10th edition.
Practice of Pharmacy, Army, 3d edition.
Preventive Medicine and Hygiene, Rosenau, 5th edition.
Modern Surgery, General and Operative, Da Costa, 10th edition.
*Modern Clinical Syphilology, Stokes, 1926.
Principles of Therapeutics, Hare, 21st edition.
Diagnostics and Treatment of Tropical Diseases, Stitt, 5th edition.
Modern X-ray Technic, Jerman, 1928.

CORRECTIONS

In the article by Doctor McCants in the April, 1931, *BULLETIN*, there occur certain typographical errors (pp. 227 and 228) which violate, unfortunately, the very rules of bacteriological nomenclature brought out by the author. These errors occur in the words appearing in the right-most column of the tables. The last two words in each item of this column should have been italicized and the last word in each item should have been uncapitalized. Under the genus *Neisseria* the spelling for the specific name of the gonococcus should have been *gonorrhæa*.

In this connection, those interested in the subject of international zoological nomenclature will find a very informing account of the present status of the matter in an article by Dr. C. Wardell Stiles in the April 3, 1931, number of *Science* (Vol. 73, No. 1892), entitled "Is an International Zoological Nomenclature Practicable?"

Doctor Stiles outlines the difficulties that have confronted the delegates in international congresses during the last 40 years. He questions "whether it is really worth while to spend further time discussing and rediscussing the same old problems and to make agreements in good faith, only to learn later that some of our colleagues, because of other premises and parliamentary technique different from that which we follow, feel at liberty to disregard these early engagements of their predecessors, because they themselves were not members of the commission when the agreement was actually made or for other reasons, and to whom a *res judicata* means so much less than it does to us."

He "maintains unreservedly" that the Padua (1930) vote on the Horn resolution was "unparliamentary and invalid," but has "grave doubts whether this point of view will be accepted by certain" of his friends and colleagues in central Europe.

He recommends "that a meeting of American zoologists interested in nomenclature be called at an early date. If a preliminary meeting be held in Washington, D. C., many members of committees on nomenclature are immediately available. This will include not only members of Washington committees, but also some of the members of practically every American national committee on zoological nomenclature. This joint committee can canvass the entire situation and make recommendations to the Washington societies which they represent and members of national committees who are present can report to their national committees as to the action taken by the Washington joint meeting. The national committees can then report to their societies with recommendations."

QUARANTINE TREATMENT OF UNITED STATES NAVAL VESSELS AT UNITED STATES PORTS

In order to promote the uniformity of procedure at United States ports in the quarantine treatment of United States naval vessels, the following instructions, supplementing Quarantine Laws and Regulations of the United States, paragraphs 140-144, have been issued by the United States Public Health Service:

Vessels of the United States Navy which carry a medical officer, upon entering United States ports from foreign ports, are exempt from quarantine inspection provided that such vessels have not sailed from a port infected with cholera, yellow fever, or plague, or in which typhus or smallpox are epidemic, and further provided that no cases of these quarantinable diseases have occurred on board en route. Naval vessels coming within the above provisions will radio to the naval authorities at the port of destination for relay to the quarantine officer, or will radio direct to the quarantine officer a report of the pertinent facts, including a statement by the ship's medical officer to the effect that no cases of these quarantinable diseases have occurred on board during the voyage. This radio will then be confirmed by a letter from the ship's medical officer, addressed to the quarantine officer, immediately after the vessel has arrived in port.

All vessels of the United States Navy which have called at any port which is infected by any of these quarantinable diseases, and all naval vessels from any port having cases of these quarantinable diseases on board at time of arrival or en route, and all naval vessels not carrying a medical officer arriving from foreign ports are required to stop at quarantine for inspection and such subsequent treatment as may be necessary.

All naval vessels sailing from ports in the possessions or dependencies of the United States bound for ports in the United States, its possessions, or dependencies, are required to take out bills of health, but in the absence of the existence of any of these quarantinable diseases in such ports of departure or

call or on board are not required, exclusive of vessels from ports in the Philippine Islands, to stop for quarantine inspection at port of arrival. Should any of these quarantinable diseases occur on board or exist in such ports of call or departure in the possessions or dependencies of the United States, then quarantine inspection is required upon arrival at ports in the United States, or its possessions or dependencies.

The evidence as to the presence or absence of these quarantinable diseases in a foreign port or a port in the possessions or dependencies of the United States is presented through American bills of health required to be taken out by the vessels at such ports of departure or call.

When two or more vessels of the smaller type, such as destroyers, one of which carries a medical officer, are cruising together, each vessel is construed as carrying a medical officer and they may be reported by radio, including each ship in the squadron or division, confirmed upon arrival by a letter from the squadron or division medical officer.

Naval transports and other vessels of the United States Navy not carrying a medical officer are subject to the same provisions of the quarantine laws and regulations as apply to merchant vessels.

All ports not in the United States, its possessions or dependencies, and ports in the Philippine Islands are foreign ports accordingly; Guantanamo Bay, Cuba, is necessarily considered under the law as a foreign port, although it is actually under the supervision of the Navy Department. Ports in the Philippine Islands have a quarantine status equivalent to that of foreign ports. A bill of health, or a supplemental bill of health, should therefore be obtained from the medical officer prior to departure, and vessels from such ports will be treated in accordance with the instructions applying to naval vessels from foreign ports.

Some misunderstanding has arisen on the interpretation of Public Health Service Circular No. 32. This may be obviated if medical officers on Navy transports will carefully examine the American bills of health obtained and determine whether those documents indicate the presence of any of the quarantinable diseases at the ports visited. If the bills of health state that any of the quarantinable diseases are present at the ports in question, it is unnecessary for the vessel to radio, since pratique can not be granted until after a quarantine inspection at the port of arrival. If quarantinable diseases are not present at the ports of call, then a preliminary radiogram is in order.

UROSELECTAN

An index of the present interest in uroselectan is shown by the March, 1931, number of the Journal of Urology. Of the 10 articles appearing in this number, 5 are on the subject of uroselectan. They are contributed by such eminent authorities as Von Lichtenberg, Braasch, Bugbee, and Lowsley. Some of these papers were read at the symposium on uroselectan during the meeting of the American Urological Society, at New York, in June, 1930.

Von Lichtenberg gives an interesting account of the development of the chemistry and the use of uroselectan. He lists the conditions in which intravenous urography is indicated, as follows:

1. Where for technical, pathological, and anatomical reasons, cystoscopy or ureteral catheterization is impossible.

2. Where ureteral obstruction prevents injection beyond the obstruction.

3. Where instrumental pyelography involves an undue risk for the patient.

Braasch, in discussing the value of uroselectan in renal lithiasis, states that "persisting angulation of the ureter, in its relation to a stone, is of greater significance in the intravenous urogram than when it is outlined by retrograde urography."

Lowsley views uroselectan as being of particular help in tuberculosis of the urinary tract, where an anaesthetic is so often required for cystoscopy and where even then ureteral catheterization is often impossible. By using uroselectan, "delay in visualization and excavation of the kidney cortex may be noted as well as granular encroachment on the lumen of the kidney pelvis and ureter."

The note of romance so inherent in the story of the development of any important discovery is far from lacking in the account of the chemistry of uroselectan given by Arthur Binz, professor of chemistry at the Landwirtschaftliche Hochschule, Berlin.

In 1921 it was Binz's idea to attach arsenic and other elements, such as iodine, to heterocyclical nuclei and to thereby possibly intensify the therapeutic power in the treatment of syphilis. He and Doctor R  th chose the simplest heterocyclical nucleus, the pyridine, and made from it the sodium salt of 5 iodine-2 pyridine. This compound proved to be bactericidal and of value in the treatment of streptococcic mastitis in cows. In 1927 it was introduced in veterinary medicine under the name *selectan*.

R  th then synthesised 73 iodine-pyridine compounds, aiming at higher iodine content and greater solubility. Selectan contains 54 per cent iodine but is only 4 per cent soluble.

In 1927 uroselectan was synthesised. It contains 42 per cent iodine and is 35 per cent soluble.

In 1928 Lichtwitz, investigating selectan neutral in the treatment of human cases of sepsis, noted its remarkable effect in visualizing the urinary tract.

In March, 1929, Binz, Lichtwitz, and Swick, working together under the direction of von Lichtenberg, investigated several iodine-pyridine compounds as to their effects in visualizing the urinary tract and found uroselectan to be the best of those yet tried.

The compound is only one-fourth as toxic as an equal amount of iodine in the form of sodium iodide.

THE SHIFT TO THE LEFT

In spite of the unquestioned high value of leukocyte counts, these counts often fail to furnish the desired information and are sometimes misleading. To overcome these inadequacies, Arneth, in 1904, relied on a classification of neutrophils according to nuclear morphology, and called attention to what is now known as the "shift to the left."

Arneth's method was later simplified by Cook and then further simplified by Schilling. Many studies have been made to evaluate Schilling's method. Notable among these is that by Gerard and Boerner, who reported their results in the December, 1930, number of the *Journal of Laboratory and Clinical Medicine*. Their report is well abstracted and discussed in the March, 1931, number of the *International Medical Digest*.

According to Gerard and Boerner, the shift is simply an increase in the immature forms as distinguished from the mature forms. They suggest an arrangement of the forms in a line according to maturity, placing the myeloblasts at the extreme left and the mature lobulated neutrophils at the extreme right. If a perpendicular be drawn through the middle of the line an increase in the immature forms will raise the number on the left side of the perpendicular and decrease it on the right.

The method of Gerard and Boerner is to make an ordinary differential count, and while doing so, to note the number of immature forms (metamyelocytes—young forms and band forms). The total number of mature cells is then divided by the total of immature cells, the result being the nuclear index.

An index between 10 and 15 is considered a slight shift to the left. An index below 5 is considered a marked shift to the left. In normal children there is a marked left shift up to 3 or 4 years of age.

Gerard and Boerner conclude from their studies that an index below 15 in adults invariably indicates an infection.

SOME LESSONS OF THE DISTRIBUTION OF INFECTIOUS DISEASES IN THE BRITISH NAVY

The *Lancet*, of March 14, 1931, prints the 1931 Milroy lecture, made this year before the Royal College of Physicians by Surg. S. F. Dudley, Royal Navy; professor of hygiene at the Royal Naval Medical College.

Morbidity in the British Navy has undergone a threefold reduction within 70 years. Part of this reduction is due to alterations in the geographical distribution of the Fleet, to a greater use of larger ships, and to a decline in the rate of recruiting, as well as to hygienic improvements and deliberate prophylactic procedures in the Navy itself. Again, an unknown fraction of

the improvement in the health of the Navy is secondary to the parallel improvement in conditions ashore; because all infection in ships is originally derived from the shore and, therefore, the naval morbidity must also depend to some extent on the quality and quantity of infection among the civilian population. Moreover, the incidence of disease in the Navy during any period is not only a function of the morbidity ashore during that period, but also depends on the conditions ashore during the 15-20 years which each member of the naval population spends in the outside world before joining the service. In regard to this point the question arises, has the general drop in morbidity ashore been in any way proportionate to the decline in naval incidence of nontropical diseases? Morbidity figures ashore are hard to come by. From Glover's discussion in last year's Milroy lectures it would seem that the incidence of rheumatism in England, especially acute rheumatism, has shown a marked decline since 1850, but a decline which is not commensurate with the sixfold drop in the naval rheumatic incidence. All things considered, I think it is fair to attribute some of the decrease in the total naval morbidity to deliberate improvements in the naval environment, and if so, the whole fall in naval nontropical disease is not merely part of a general phenomenon.

One important lesson this naval study teaches is, that, under conditions of maximum population density, the incidence of droplet-borne disease need be no higher than among a similar age-group living in far more spacious surroundings. And I think this observation illustrates a principle of wide application—namely, that density, other factors being equal, is not necessarily associated with an increase in clinical infection even should it be constantly associated with increased latent infection. For example, if a long enough period is taken, it is found that in recent times the rural morbidities of many infectious diseases may be higher than the urban.

An unexpected discovery was that during the last 70 years there had been no reduction in the mean duration of any common infection (except syphilis). Thus modern treatment can have had no significant effect in curtailing the time required for individual infections to run their course. There is no obvious reason for not believing that this observation would be found to be universal, if statistical data as complete and reliable as that for the Navy were available for other environments.

The lack of any significant variation in the geographical distribution of respiratory disease in the Navy was rather unexpected. This phenomenon could be a specific character of the naval community, which results from its keeping the same immediate environment wherever it goes. Moreover, every time a ship commissions at a home port for foreign service (for two or three years) she embarks a fresh stock of home-grown bacteria. On the other hand, Europeans abroad live most of their lives away from home and in general occupy far more spacious and better-ventilated quarters than they would in England, and also the number and closeness of their contacts with their fellow men is almost negligible as compared with the naval community. Hence the impression of most tropical practitioners that respiratory infections are comparatively uncommon among Europeans dwelling in the tropics may be correct. Nevertheless, impressions are treacherous and there is much evidence that in the densely populated native towns of the tropics respiratory disease is as rife as in Europe. For example, Rogers shows by comparing a series of postmortem examinations in Calcutta and London that respiratory disease was a more common cause of death in the Indian than English sample. But these figures do not differentiate between natives and Europeans; also, mortality is not always directly proportional to morbidity.

Whether naval respiratory disease in the tropics is caused by English bacteria indigenous to the ship itself, or by organisms introduced from the immediate port of call, the one thing which strikes the observant naval surgeon when first he goes abroad in a big ship, after doing an intensive course in strange tropical diseases, is that he does not see them; and each morning he finds, awaiting him in the sick bay, a very similar collection of ailments, whether his ship is lying in Hong-Kong, Trinidad, or Portsmouth harbor.

THE PRESENT STATUS OF THE CANCER PROBLEM

The January, 1931, number of the *Annals of Surgery* is one of the extraordinary pieces of the mass of medical literature that has appeared during the current year. This number is dedicated to James Ewing, both to felicitate him on the occasion of his sixty-fourth birthday and to honor him for the stupendous contributions he has been making to our knowledge of the neoplastic diseases during these last 30 years.

This issue of the *Annals* could well serve as an advanced text on cancer. It is divided into four parts: Cancer in its General Relations; Cancer Research; Regional Cancer; Radium and Röntgen Ray Therapy of Cancer. The contributors are of the first ranks of the profession in America, Belgium, Canada, England, France, Germany, Holland, Italy, and Sweden. No small amount of inspiration will be found in An Appreciation by William H. Welch and in the foreword by Frank E. Adair.

In the second article, entitled "The Present Status of the Cancer Problem," Dr. C. C. Little well summarizes the matter.

Although no startling discoveries have been made, the sum total of gradual progress has been considerable, and Doctor Little believes that in the next few decades there will be still further and very important advances in our knowledge of cancer.

"More satisfactory and complete methods of classifying and of differentiating between the various types and degrees of cancerous growth will have to be established." Treatment must be improved and refined and new lines of attack developed. The layman must be educated so that cancer may be recognized earlier, treated earlier, and the various forms of irritation productive of cancer, avoided. Long and painstaking research will be needed before we have a sufficiently clear understanding of the cause or causes of cancer.

Animal experiments in hereditary factors give more promise and are much more dependable than human data, Little believes, but he adds that serious mistakes have been made in animal work by ignoring essential methods of genetic control, and this has resulted in contradictory and inconclusive findings.

Another confusing factor has been the many forms of cancer and the fact that hereditary factors are probably different in these different cancer types.

* * * By more accurate and more extensive vital statistics we are able to detect at as early a date as possible any correlations existing between cancer and age, race, sex, occupation, and a whole grist of abnormal or pathological conditions of anatomy or of physiology. Furthermore, such studies give us the only reliable basis for determining the actual increase or decrease of the incidence of cancer of any given type. Improved methods of diagnosis, a higher percentage of hospitalization, the extension of the average period of life, and more and better autopsies are all factors that may contribute to *recognition* of cancer. This in turn may give the appearance of an actual *increase* in cancer incidence, although it may not have increased in the least.

* * * Recent studies in experimental morphology and embryology are beginning to give us a preliminary picture of the complex relationships which exist inside the body of a mammal. We are still far from being in a position to understand the situation, but a beginning has been made. As a result the importance of the various physiological elements which contribute to the development and control of such processes as growth is becoming more and more clearly recognized.

The present methods of treatment have the dangers of being incomplete, and X ray or radium have also the danger of injuring normal tissue and stimulating abnormal growth.

There are surprisingly few hospitals in the United States in which adequate "follow-up" methods for cancer patients is attempted. The development of clinical centers in large cities for the diagnosis and treatment of cancer and more thorough "follow-up" methods should eventually result in more reliable data as to the value and dangers of our present methods of treatment.

* * * Instead of recognizing the challenge offered by cancer as being an outstanding menace about which pathetically little is known and for the combating of which the utmost cooperation is needed, the medical profession fights shy of grappling with the problem and looks for easier foes to conquer. This attitude will have to be corrected. The spread of popular interest in cancer, coupled with a marked decrease in ignorant fear and superstition concerning it, will undoubtedly in the near future result in a popular demand by the laity for better equipped medical men to cope with the situation. Then, if not before, medical schools and the medical profession as a whole will take the long overdue steps toward more up to date and extensive training of their personnel.

TRANSVERSE INCISION FOR OPERATIONS ON URINARY BLADDER

In the first edition of Kelly's Operative Gynecology (1898) he mentions the possibility of using the transverse incision for removing bladder growths, but deprecates it because of the increased difficulty in closing such a wound. In 1914 he must have had a better opinion of the incision, for he devotes four pages to the subject of

transverse suprapubic incision in the book he wrote that year with Burnam.

In 1913 MacGowan described the incision and recommended its use for suprapubic cystotomy. In 1929, B. W. Wright discussed the method at the annual meeting of the American Urological Association. This discussion led O. S. Lowsley to utilize the method, and he reports his results in a series of 45 cases in the February, 1931, number of the American Journal of Surgery.

Lowsley uses a modification of the MacGowan technique. This he describes as follows:

It is our impression that it is most important to have the drainage tube inserted into the highest possible point of the vesical fundus and that the course of the fistula remaining after removal of the drainage tube should be obliquely upward to the highest possible point in the skin incision. This position will aid materially in the rapid closing of the wound because the pressure of abdominal contents upon the oblique passage will aid in its closure by mechanical pressure.

An important consideration lies in the fact that if the fistula and its resulting scar are high and subsequent operation is necessary, the peritoneum is held well up out of harm's way and the second incision below this point is unattended with the danger of penetrating the peritoneum.

With these facts in mind we decided that the most suitable incision was an inverted V incision, the apex of which should be well above the point to which the dome of the distended bladder would reach. It is, therefore, our practice in doing an ordinary suprapubic cystostomy to incise with the apex of the inverted V at a point about three-fourths of the distance between the symphysis pubis and umbilicus.

The incision is deepened through the skin and subcutaneous tissue, the sheath of the recti on each side is incised, and if the recti are firm, strong muscles, they are cut across either partially or entirely, as the case may demand. The obliterated hypogastric vessels and the urachus are encountered, and by dissecting along the latter structure with care, one is led directly to the highest point of the vesical fundus.

By careful blunt dissection the peritoneum may be easily separated from the bladder wall without approaching, even, the space of Retzius. On account of the fact that there is no excavation necessary behind the symphysis pubis, we have not found it necessary to stitch the bladder to the rectus as MacGowan and his followers do. This is due to the high incision which we employ.

* * * The fibers of the recti are approximated with plain interrupted catgut stitches and the fascial coverings of the recti are sutured with continuous plain catgut. The skin is closed in the usual manner with interrupted silkworm gut sutures, one of which is tied around the double suction tube, fixing its position at the surface.

In cases requiring more efficient exposure of the bladder such as resection of vesical neoplasm with transplantation of the ureter or resection of vesical diverticula it is found useful to make the incision midway between the umbilicus and symphysis. In this manner the entire pelvis is laid open and the exposure is very much superior to any that the author has used or seen. In fact even the most difficult operations in the pelvis are rendered infinitely more simple by utilizing this incision.

Lowsley's conclusions are as follows:

1. This operation is easily accomplished under regional anæsthesia.
2. The inverted V allows the drainage tube to be placed high in the fundus of the bladder and high in the skin wound, to course obliquely through the abdominal wall. This makes for rapidly healing fistulæ.
3. In case a secondary operation is to be performed, the incision may extend from the fistulous tract to the symphysis through virgin tissue without fear of injuring the peritoneum.
4. The danger of pelvic cellulitis is eliminated because the space of Retzius is not opened.
5. In this series of 45 cases there have been only 6 cases of infection of the suprapubic wound; all others have healed by primary intention. The average time required for the suprapubic fistula to close was 11.9 days.
6. The view obtained by the utilization of this incision is so satisfactory that the most extensive vesical resections and plastic operations upon the lower ends of the ureters are rendered infinitely easier for the operator as compared with the usual approach.

THE NEED FOR "STANDARDS" IN INVESTIGATIVE AND THERAPEUTIC WORK IN GASTROENTEROLOGY

Dr. Frank Smithies, in his 1930 presidential address before the American Gastro-Enterological Association (published in February, 1931, number of the American Journal of Surgery), decries the confused state and other faults of present methods of investigation in gastroenterology.

He states that the test meal as used to-day can be of little value in measuring gastric function, since carbohydrate cleavage is already well advanced by the time food reaches the stomach, and, moreover, a test meal consisting of 75 to 90 per cent carbohydrate is used in testing the digestive capacity of an organ that has to do primarily with the initiation of peptic digestion.

Certainly it would seem that if clinicians and students are to place any reliance whatever upon the test-meal study of gastric function, meals must be employed which call forth not only primarily digestive secretion in the stomach itself but the secondary or hormonal effects of properly initiated and maintained gastric digestion upon pancreatic, hepatic, and enteric secretion and motility.

He speaks of the need for information upon what in health the stomach is able to do digestively toward mixed meals. Standards for variations in the different decades of life, the sexes, races, different seasons, etc., are also needed.

Misinformation supplied by gastric analysis has led physicians to the false idea that hyperchlorhydria means ulcer and that "sour stomach" means excess acid secretion, in some way initiated by an ulcer. "Sour stomach" usually means only that gastric acid, because of increased gastric tonus, reaches the esophagus above the normal regurgitant zone.

Test-meal studies will have much more value when a large amount of data is at hand correlating acidity figures with different types of ulcer and with ulcer at various sites in the stomach.

As to progress meals of which we may obtain X-ray films, these merely indicate, in individuals or groups of individuals, how a similar foreign body is passed through the alimentary tract. It is readily seen how confusion arises in attempting to appraise the meaning of residues in various viscera or parts of viscera; in fact, one need only study the same patient by several progress series to appreciate the difficulties of correct interpretation. If the same individual exhibits such great variation, then it is not to be wondered at that groups of individuals exhibit variations which often prevent any sort of intelligent comparison, diagnostically. What effect upon the progress of Röntgen meals through the alimentary canal have absences, deficiencies, or increases of digestive secretion, or of disturbances in the correlated neuromuscular activity and tonus, has not been determined.

* * * It is our hope that, before long, a committee can be formed which will pass upon what is useful and what are "frills" and that when this has been accomplished, gastrointestinal invalids can be examined with less discomfort, the results of their test maneuvers will mean something helpful toward the elucidation of their ailments, and reports of their studies will be broadly comparable and hence instructive.

THE NEW CYTOLOGY

Writing in the March 20, 1931, number of Science, Dr. Alexis Carrell explains at considerable length the need for and importance of a cytology which goes beyond the classical histological concepts of form and structure and takes into account the system of cells environment, of which the structural, functional, physical, physicochemical, and chemical conditions are considered in time as well as in space.

He also gives a rather complete outline of what has already been achieved in this study.

Cytology, understood in the full meaning of the word, utilizes three groups of techniques—1, ordinary chemical, physicochemical, and physical techniques; 2, cytological and histological techniques; 3, physiological techniques that permit the isolation of pure strains of tissues and blood cells, and the study of the structural and functional characteristics of these cells while they live in media of known composition.

* * * Tissue and blood cells do not show their true physiognomy when they are examined under the microscope. Cinematography alone is capable of recording their fourth dimension. Fixed cells appear on the film as mobile as a flame. Their surface is never smooth. In some places, it bubbles like boiling water. Their body is composed of a fluid in which are suspended parts of a greater consistency, the nucleus and other organs. The nucleus, similar to an elastic ball, is surrounded by a belt of snake-like mitochondria which push it forward. Close to the nucleus and carried along with it by the cytoplasmic stream is a group of vesicles adherent to one another, resembling a bunch of grapes. They are the segregation apparatus of Renaut and the Golgi net. Through the anterior process, the cytoplasm seems to flow as a stream into the medium. Ameboid cells differ profoundly from fibroblasts and epithelium on account of the sharp definition of their surface and of their more rapid motion. The polymorphonuclear leucocytes are small and very agile amebas; the lymphocytes creep slowly like little worms; and the blood and tissue macro-

phages, which progress in an octopuslike manner, are surrounded by an almost invisible, undulating membrane. The folds of this membrane have the appearance of flagellate pseudopods.

* * * Fibroblasts organize in a matted tissue where individual cells are in close but irregular contact. They never live as isolated units. A colony of fibroblasts looks like a dense crowd which moves without order. Very rarely do individuals wander far from the main group, which is composed of cells sliding upon one another in every direction. The colonies of epithelial cells associate in a more orderly manner. They can be compared to a regiment where each individual occupies an assigned place. Ameboid cells behave in quite a different way. They never form a tissue. They resemble a band of children scattering in every direction, with no other purpose than to run. While epithelial cells and fibroblasts aggregate in a tissue of limited dimensions, macrophages invade the entire medium at their disposal, as do bacteria. This tendency to retain a definite mode of colony formation persists in cells even after several years of life in vitro.

* * * A monocyte increases in size at least 10 times when it is well fed. Pure plasma transforms macrophages into large cells surrounded by an undulating membrane and grouped like a thick undergrowth of bushes. The addition of amino peptones, sodium sulfide, or enzymes from various organs, etc., may bring about the loss of the undulating membrane and the appearance of snake-like and fibroblastic forms or the transformation of the mobile into mast-like cells. These changes are reversible. In a few days the cells can be brought back to the state of macrophages with undulating membranes. When nitrogenous food is replaced by Tyrode solution, they grow smaller and revert to the dimensions of monocytes. Irreversible changes may be induced by certain media. During the digestion of their coagulum, macrophages that have been inoculated with extracts of Rous sarcoma transform into fibroblasts. Fibroblasts, treated with heparined plasma, may become macrophages. They acquire all the physiological properties of macrophages and remain indefinitely in that state.

* * * The isolation, in pure cultures, of a few strains of malignant cells has led to a simple method of investigating their nature. This method consists in comparing them with strains of normal cells of the same type from the point of view of their physiological and structural properties. At once the characteristics that cause malignant cells to differ from the normal ones become apparent. The macrophages of Rous sarcoma are diseased cells. They show many abnormalities, degenerate rapidly, and are short lived. They possess the same food requirements as do normal macrophages, and their acid production is no greater. But they actively digest the fibrin of the coagulum, whereas this is not true of normal macrophages.

* * * Studied in this manner, cells and tissues appear as being endowed with properties which make them not only the building stones but also the builders of an organism capable of developing, maturing, growing old, repairing wounds, and resisting or succumbing to diseases. It is with such an aspect of the tissues that embryology and pathology, as well as cytology, should be concerned.

* * * Although descriptions of the changes produced in cells and tissues by pathogenic factors fill many books, the mechanism and the significance of these changes remain practically unknown. This shortcoming must be attributed to the fact that cellular pathology, like histology, is based on an incomplete conception of the nature of tissues. The adaptation of the body to diseased conditions can not be understood as long as cells are conceived to be

mere structural units. However, by taking into consideration the physiological properties of tissues as manifested under the influence of bacterial and other chemical changes in the organic medium, the doctrine of Virchow could be rejuvenated and extended to the whole field of pathology.

NAVAL MEDICAL SCHOOL LIBRARY

A board was recently appointed for the purpose of formulating a program of reorganization of the Naval Medical School Library. This appointment was particularly timely, since the board's report contains many features which can be applied from the start when the library moves into its new quarters upon completion of the construction of the new Naval Medical Center building in Washington.

The report embraces such matters as the correction of certain deficiencies in periodicals and books to complete now missing volumes of desired publications; the survey of now worthless publications; complete cataloguing; additional librarian help for proper management; establishment of a permanent committee to decide on annual subscription list of periodicals and on purchase of new books of special interest to naval medical officers; the development of a special department which will include books and all periodicals (in all languages) on military medical subjects and on naval or marine hygiene.

It is particularly desired to maintain a library which will be second to none in the world in books and periodicals on naval medical subjects.

A large number of periodicals issued by the medical departments of the various navies is already being received. The latest acquisition to this list is the quite impressive appearing new *Revista de Sanidad Naval*, the official bimonthly publication of the department of health of the Chilean Navy.

NINETY IMPRESSIVE MEDICAL BOOKS OF RECENT ISSUE

It has fallen to the lot of this writer to examine rather closely during the past few years a very large number (about 1,000) of new books on various medical subjects. Out of the lot he was particularly impressed with about 90. In making up this list it must be explained that the various specialties were not represented equally among the large number of books reviewed. Neither was the reviewer's interest divided equally among the specialties, although it is true that some of the books that impressed him most favorably were those that concerned specialties in which he was least interested.

Nor does the list represent the choice from the entire field of medical books published. There were perhaps a few thousand medical

books published during the period, which this reviewer did not see at all, and among which there were very probably several that would have been placed on this list in preference to some that now appear on it.

Moreover, the list is only an expression of a particular reviewer's particular taste in medical literature. In a great many instances, however, the choice is supported by the opinions of several associates who chanced to look over the same books.

With all the above explanations and reservations, the list appears below. Those preceded by an asterisk were considered to be either especially valuable contributions to the world's medical literature or especially readable and attractive.

ANATOMY

- Toldt—An Atlas of Human Anatomy, 1928.
* Warren (Green)—Handbook of Anatomy, 1930.
Gray (Lewis)—Anatomy of the Human Body, 1930.

DERMATOLOGY

- Andrews—Diseases of the Skin, 1930.
Pusey—Principles and Practice of Dermatology, 1926.

DIAGNOSIS

- French—An Index of Differential Diagnosis, 1928.
Norris and Landis—Diseases of the Chest and the Principles of Physical Diagnosis, 1929.

GYNECOLOGY

- Curtis—A Textbook of Gynecology, 1930.
Walscheld—Abdomino-Pelvic Diagnosis in Women, 1931.

HISTORY OF MEDICINE

- *Garrison—History of Medicine, 1929.
Malloch—William Harvey, 1929.
Roddie—Edward Jenner and the Discovery of Smallpox Vaccination, 1930.
*Packard—History of Medicine in the United States, 1931.
*MacCallum—William Stewart Halsted, 1930.
Rolleston—Sir Thomas Clifford Allbutt, 1929.
Fulton—Physiology (Clio Medica Series), 1931.
*Cushing—Sir William Osler, 1925.
Dana—The Peaks of Medical History, 1927.
Wilson—Sir James Mackenzie, 1926.
*Warthin—The Physician of the Dance of Death, 1931.

LABORATORY

- Kahn—The Kahn Test, 1928.
Park, Williams, and Krumwiede—Pathogenic Microorganisms, 1929.
Schilling—The Blood Picture and its Clinical Significance, 1929.
Faust—Human Helminthology, 1929.

- Craig—Laboratory Methods of the United States Army, 1929.
Piney and Wyard—Clinical Atlas of Blood Diseases, 1930.
*McLeod—Physiology and Biochemistry in Modern Medicine, 1930.
Topley and Wilson—The Principles of Bacteriology and Immunity, 1930.
*Zinsser—Resistance to Infectious Diseases.

MEDICINE

- Stimson—A Manual of Common Contagious Diseases, 1931.
Hare—A Textbook of Practical Therapeutics, 1930.
Harrop—Diet in Disease, 1930.
Joslin—The Treatment of Diabetes Mellitus, 1928.
Lord—Pneumonia, 1929.
Simpson—Tularemia, 1928.
Pemberton—Arthritis and Rheumatoid Conditions, 1929.
Clendening—Modern Methods of Treatment, 1929.
Chadwick and McPhedron—Childhood Type of Tuberculosis, 1930.
*Crummer—Clinical Features of Heart Disease, 1930.
*Alvarez—Nervous Indigestion, 1930.
*Cecil et al.—A Textbook of Medicine, 1930.
*White—Heart Disease, 1931.

MISCELLANEOUS

- Emerson et al.—Physician and Patient, 1929.
*Warthin—Old Age, The Major Evolution, The Physiology of the Aging Process, 1929.
*Cowdry et al.—Human Biology and Racial Welfare, 1930.
*McCollum—The Newer Knowledge of Nutrition, 1928.
*Pearl—Introduction to Medical Biometry and Statistics, 1930.
DaCosta—Selections from Paper and Speeches, 1931.
Adair et al.—Cancer (International Contributions), 1931.
Eyster—Clinical Aspects of Venous Pressure, 1929.
Chandler—Hook Worm Disease, 1929.
Rackemann—Clinical Allergy, etc., 1931.

NEUROLOGY AND PSYCHIATRY

- Neustaedter—Textbook of Clinical Neurology, 1928.
Jelliffe and White—Textbook of Neurology and Psychiatry, 1929.
Kuntz—The Autonomic Nervous System, 1929.
*Menninger—The Human Mind, 1930.

OPHTHALMOLOGY

- May—Manual of the Diseases of the Eye, 1930.
Thorington—Refraction of the Human Eye, 1930.

OTOLOGY, RHINOLOGY, AND LARYNGOLOGY

- Jackson and Coates—The Nose, Throat, and Ear and Their Diseases, 1930.
Kopetsky—Otologic Surgery, 1929.
*Fowler—Tonsil Surgery, 1930.
Keeler—Modern Otology, 1930.
*Negus—The Mechanism of the Larynx, 1930.

PATHOLOGY

- * Boyd—Surgical Pathology, 1928.
- * Boyd—Pathology of Internal Diseases, 1931.

PEDIATRICS

- Holt and Howland—The Diseases of Infancy and Childhood, 1929.
Marriott—Infant Nutrition, 1930.

PHYSIOTHERAPY

- Stewart—Physiotherapy, Theory and Practical Application, 1929.

PREVENTIVE MEDICINE

- Dunham—Military and Preventive Medicine, 1930.
Rosenau—Preventive Medicine and Hygiene, 1927
Boyd—An Introduction to Malariology, 1930.
Mustard—Cross Section of Rural Health Progress, 1930.

UROLOGY

- Pelouze—Gonococcal Urethritis in the Male, 1928.
Eisendrath and Rolnick—Urology, 1928.
* Joly—Stone and Calculous Disease of the Urinary Organs, 1929.
Lowsley and Kirwin—Textbook of Urology, 1926.

TROPICAL DISEASES

- Stitt—Diagnostics and Treatment of Tropical Diseases, 1929.

SURGERY

- * Sachs—Diagnosis and Treatment of Brain Tumors, 1931.
Speed—Fractures and Dislocations, 1928.
Wilson—Fractures and their Complications, 1931.
Babcock—Textbook of Surgery, 1928.
DaCosta—Modern Surgery, 1930.
Labat—Regional Anesthesia, 1929.
McPheeters—Varicose Veins, 1930.
Whitman—A Treatise on Orthopedic Surgery, 1930.
Rose and Carless—Manual of Surgery, 1930.
Stewart and Lee—A Manual of Surgery, 1931.

SYPHILIS

- Stokes—Modern Clinical Syphilology, 1926.

X RAY

- Buckstein—Peptic Ulcer, 1930.
Sante—The Chest, 1930.

MENINGOCOCCEMIA WITH ENDOCARDITIS

Three case histories of meningococcemia with endocarditis are cited by Arthur M. Master, New York (Journal A. M. A., Jan. 17, 1931). The characteristic symptoms and signs of meningococcemia are de-

scribed and the differential diagnosis is discussed. Physical signs are apt to be few. A slow pulse rate relative to the temperature was present in two of the three cases. Some authors feel that antimeningococcic serum treatment has caused the recovery of their patients. In the three cases described, it was difficult to evaluate the importance of this treatment. Clinically, and by the aid of the teleroentgenogram and the electrocardiogram, signs of endocarditis were believed to be present in each of the three cases. In addition, the literature supplies numerous cases of just this type. It appears that the meningococcus can involve the endocardium, myocardium, or pericardium. For these reasons it is believed that in meningococcemia the valves may be the source of reinfection of the blood stream. The similarity of meningococcic endocarditis to subacute bacterial endocarditis is remarked. Recovery is not unusual in meningococcemia with endocarditis. There is a disappearance of clinical evidence of a bacterial endocarditis. Spontaneous healing may have occurred. It is felt that, if careful observations are made with the view of establishing the presence of an endocarditis, a surprisingly large number will be found. Where an endocarditis has been described in the literature, the author has usually emphasized a bad prognosis. In the three cases reported here, nevertheless, recovery took place.

THE HEALTH OF HAITI

The Annual Report of the Director General, Public Health Service, of Haiti, for the year ending September 30, 1930, is, as in recent past years, a very absorbing and beautifully illustrated document.

It contains a record of remarkable progress in many directions. It reflects the extraordinary zeal with which the public health personnel—Americans and Haitians—have been striving to better the sanitary conditions of Haiti and to provide the large population with proper medical care.

Several Americans have been replaced by Haitians during the last two years, and the remaining Americans will be gradually replaced by Haitians during the next five years. The Haitian members of this large force are, for the most part, meeting their new tasks and new responsibilities in an admirable fashion.

The major problems are supplied by treponematoses, malaria, intestinal parasites, tuberculosis, typhoid, and cerebrospinal fever. As in other recent years, more than a half million patients were treated for treponematoses.

Major events during the year were the political disturbances at Aux Cayes, December 6, 1929, and the Santo Domingo hurricane, September 3, 1930.

The report contains especially interesting and valuable articles on—

Rural and Traveling Clinics—P. W. Wilson and M. S. Mathis.

Spirochete and Yaws—F. H. Webster.

Division of Laboratories—J. H. Chambers.

Division of Quarantine and Sanitation—S. S. Cook.

REMOVAL OF SICK BAY BATHTUB

In the interest of economy of space, several medical officers have suggested that the sick bay bathtub, which is generally thought to be of small use, be removed. Some have suggested that it be replaced by a shower or by an additional toilet.

The tub has already been removed from the sick bay of certain ships as a matter of trial; that is, in order to permit medical officers to form an opinion as to its necessity or desirability.

The bureau will welcome any comment or suggestions on the subject from medical officers.

MORTALITY FROM INFLUENZA AND PNEUMONIA IN 50 LARGE CITIES OF THE UNITED STATES, 1910-1929

A report recently issued by the United States Public Health Service deals with influenza and pneumonia mortality in the 50 cities of the United States that had 100,000 or more in population in 1910. For 35 of these cities, with an aggregate population of nearly 25,000,000, the number of deaths from influenza and pneumonia by weeks are available from September, 1918, to the present time. Deaths for the country as a whole are not available by weeks, and so these data for this large group of cities have considerable significance. To supplement them, monthly influenza and pneumonia death rates have been computed for the same cities for the years 1910 to 1918.

Since 1915 there have occurred 10 distinct periods, each of 8 to 31 weeks' duration, in which the mortality from influenza and pneumonia in this group of widely dispersed cities was so greatly increased as to denote epidemic conditions. Minor epidemics prior to the 1918 pandemic occurred in January, 1916, January, 1917, and April, 1918, with a very light rise in the mortality in April, 1915, also. We are accustomed to think of the epidemic of 1918 as occurring in the fall, and it is true that the enormous peak, which oc-

curred in the middle of October, overshadowed all prior and subsequent recorded epidemics. In addition to this tremendous peak, the epidemic stretched out over a period of 31 weeks, from September 15, 1918, to April 19, 1919; and even as late as the latter part of January, 1920, the mortality from influenza and pneumonia in excess of the expected rates for that season of the year was greater than the excess mortality during the epidemic of 1929.

In the early months of 1920 a very sharp epidemic occurred, with excess mortality greater than during any other epidemic since the 1918 epidemic. In February, 1922, February, 1923, March, 1926, and January, 1929, other epidemics occurred, and in May of 1928 there was a slight rise in the influenza mortality which extended to many sections of the country. The combined excess mortality from influenza and pneumonia during these six epidemics that have occurred since the pandemic of 1918 was only about one-half of that of 1918-19.

In addition to the data for the group of cities, this report contains monthly excess death rates for each of the 50 cities throughout the period 1910-1929 and weekly excess death rates for a large number of the cities during the three major epidemics, 1918-19, 1920, and 1928-29. In every one of the various epidemics, even including the pandemic of 1918-19, there is great variation in the severity of the different epidemics in different cities. Moreover, there are periods of excess mortality from influenza and pneumonia in certain cities and sections of the country which are not of sufficient importance to show up in the combined data for the country as a whole.

The report is intended as a rather detailed history of influenza and pneumonia mortality during the past 20 years as a background for the consideration of the present situation with respect to the respiratory diseases.

AMERICAN PUBLIC HEALTH ASSOCIATION ANNUAL MEETING

The American Public Health Association announces its sixtieth annual meeting, September 14-17, in Montreal, Quebec, with the Windsor Hotel as headquarters.

The association has not held a meeting in Canada since 1908, and public-health workers from the Dominion and from the United States are invited to take advantage of this opportunity for closer contact. The program is being planned with the progress and needs of both countries in mind. Such subjects as toxoid immunization; rural sanitation, particularly the organization of a practical program for county health units; health education for a large city, for a small city, and for a rural community; camp and resort sanitation, includ-

ing fungus skin infections, particularly those transmitted in swimming pools, and general sanitation of auto camps, have been considered so important by the program committee that special sessions will be devoted to them.

Each section of the association will arrange individual programs, covering public-health administration, laboratory research, vital statistics, public-health engineering, food, drugs, and nutrition, child hygiene, public-health nursing, health education, epidemiology, and industrial hygiene.

Meetings of four other organizations—American Association of School Physicians, Conference of State Sanitary Engineers, International Society of Medical Officers of Health, and the International Association of Dairy and Milk Inspectors—will take place during or immediately preceding the sessions of the American Public Health Association in Montreal.

For further information address the American Public Health Association, 450 Seventh Avenue, New York, N. Y.

THIRD CONGRESS OF THE PAN AMERICAN MEDICAL ASSOCIATION

The organization committee of the Third Congress of the Pan American Medical Association has extended a cordial invitation to those who are interested in medical interchange among English, Spanish, French, and Portuguese speaking doctors of Pan America to attend the next meeting, which will be held at the City of Mexico from the 26th to the 31st of July, 1931, under the auspices of the Government of the Republic of Mexico.

This medical conference meets for the purpose of maintaining and promoting a more intimate understanding between the medical men of the New World, and, with the efforts of many prominent North and Latin American physicians, a great success has been accomplished in the past meetings.

The proceedings of these congresses reveal a record of achievements so necessary for the better scientific knowledge among our countries and a definite step toward international medical progress.

The object of this organization is to promote more intimate relations among physicians and surgeons of the Western Hemisphere; to develop friendship and to advance medical knowledge such as the possibility of an interchange of doctors for the purpose of presenting medical courses and holding meetings in different countries; the exchange of medical literature and of the dissemination of information regarding scientific investigations and to create an international lending library; to develop an inter-American medical literature by means of official publications.

Information can be obtained from—

Dr. Francisco de P. Miranda, executive secretary of the organization committee, Departamento de Salubridad Publica, Mexico City, Mexico.

Dr. Conrad Berens, treasurer Pan American Medical Association, 35 East Seventieth Street, New York City.

Dr. José E. Lopez-Silvero, executive secretary of the Pan American Medical Association, Secretaria de Sanidad y Beneficencia, Habana, Cuba.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

THE HISTORY OF MEDICINE IN THE UNITED STATES, by *Francis Packard, M. D.*, with chapters on the Medical Departments of the Army and Navy by *P. M. Ashburn, Colonel, Medical Corps, United States Army*, and *R. P. Parsons, Lieutenant Commander, Medical Corps, United States Navy*. Second edition, Volumes I and II. Paul B. Hoeber, Inc., New York, 1931.

A great many people are of the opinion that the value of history is less than nothing; that is, that the possessor of historical knowledge is in a worse position than he who is ignorant of it; that historical facts are misleading, that they are of no purpose, that they warp and diminish our interest in or our perspective of the much more important events and issues of the present and future; in brief, that the pursuit of historical knowledge, far from being profitable, is wasteful and damaging. Mr. Henry Ford has expressed such an opinion of history, though in fewer and more emphatic words.

If history has no purpose, then experience has no purpose, for history is simply a recorded form of experience, a short cut to experience; perhaps not as vivid and impressive as personal experience, but holding the same values and interests. Through experiences we form philosophies; and it is just this fact that makes history so worth while and so absorbing, for most history either contains or implies more substance of the philosophical than of the purely historical.

Leaving the question of its utility, let us judge it purely on the ground of enjoyment, the cultural satisfaction that comes with its knowledge, the satisfaction of appeasing our curiosity. The judgment is easily formed. One's interest in history always rises with his knowledge and understanding of it. The more one reads of well-written history the more one enjoys it, the more one feels the lure of it, and, finally, the more one sees the sense of it, the practical value of it, and the philosophy in it.

Some historians quibble endlessly over such academic niceties as precise dates and names or over priorities of quite minor importance and thus lose sight of the broad issues. Others show a laudable discrimination in their patterns and give us a well-balanced ration—space to the essentials and footnotes to unimportant details that impede the continuity of the story.

Packard is one of these latter. We have waited a long time for this second edition of his earlier work because there was absolutely no other book of recent issue that covered just this subject. We waited in anticipation of a rich historical treat. We were by no means disappointed, for the book, besides serving as a veritable reference encyclopedia in this section of the history of medicine, furnishes the reader with many hours of fascinating entertainment, bringing to him a close acquaintance with the characters that built what we call broadly "American medicine" and a familiarity with the world in which they lived.

As the story unfolds we see the history of America as well as the history of American medicine and we see how closely the two are interwoven. We see great epidemics, great men, great pioneers, great trends in medical education, in practice, in hospital work, in legislation, in research, great advances, improvements, developments. We see how they came about and why they came about. Almost every page contains something that we can translate into doctrines for present-day use, into our modern outlook on medicine, our contemplation of problems that we face to-day and shall face to-morrow.

The story begins with medical events connected with the early history of the English colonies in America. Here we see, in the absence of accredited physicians, medical aid being given by persons in high political office (Governor Winslow, Massachusetts, and Governor Winthrop, Connecticut), and very often by the clergy. We see college presidents becoming interested in medicine and medical schools; we see medical men becoming college presidents. (Chauncey and Hoar were presidents of Harvard, and Dickinson, who graduated at Yale, 1706, became the first president of Princeton.) We see great changes in attitudes toward medical work as medical knowledge increased. For example, it was, until about 1750, beneath the dignity of a doctor to handle obstetrical cases, these being always left to the midwives.

Until about 1800 there were frightful waves of mortality from the epidemic diseases that frequently swept our country. These disasters often fell with the greatest terror and violence upon shiploads of Puritans and other emigrants to America. On one notable voyage in 1618 from Amsterdam to Virginia 130 of the 180 persons on board died en route. Thirty on board died of smallpox during the voyage

that brought William Penn (1682) to America. Of the 4,000 emigrants to Virginia between 1619 and 1621, mostly male adults, only about 1,800 remained alive by 1624. There was a 50 per cent mortality among the Pilgrim fathers who arrived at Plymouth in 1620, this probably largely from scurvy.

The story of the introduction of inoculation against smallpox in America about 1721 and of vaccination about 1800 is much like other great innovations—a few keen observers (e. g., Cotton Mather and Doctor Boylston and later Benjamin Waterhouse) seeing its tremendous possibilities but having to struggle against the inertia, incredulity, and sometimes the violent opposition of their colleagues.

Just as thrilling as the smallpox story is that of yellow fever. Yellow fever contributed some of the most frightful epidemics, even in the northern cities, and led to some of the greatest medical controversies, notably the one in which Benjamin Rush figured so prominently during the 1793 epidemic in Philadelphia; also it furnished the ground for what was perhaps America's very greatest achievement in medical research—the classical observations of Henry Carter in 1897 and the epochal experiments of Walter Reed in 1900 which sounded the exit of yellow fever from the United States.

We are taken on an extensive sight-seeing tour through the earliest hospitals in America, where we learn that the Pennsylvania Hospital (established 1750) was antedated only by certain hospitals in Canada and Mexico. This clears away a popular misconception concerning the priority of the Blockley Hospital, which existed only as an almshouse until 1768.

We see hospitals and dispensaries springing up before and shortly after the Revolution in places where they were most needed or where their value was most realized. We find the New York Hospital on the map by 1776 and containing a library of 3,000 volumes by 1811. The need for hospitals for the insane was felt early in Philadelphia and New York, and a great need for reform in the treatment of the insane was realized even before 1800, Rush being the principal champion of the cause in Philadelphia. The lunatic asylum of the New York Hospital was built in 1808 and became the direct ancestor of the present hospital for the insane at Bloomingdale. The establishment of the "New York Institution for the inoculation of the Kine Pock" (1802) marked the recognition of one of the earliest great weapons in preventive medicine. (Quarantine legislation and quarantine hospitals, however, existed almost a century earlier, especially in Boston.) If not the earliest, Blockley was, at any rate, the one that left the deepest and fondest impress both in recorded history and in the memories of its alumni. A bare listing of a few members of its earlier staffs offers sufficient explanation for Blockley's historical position: Rush, Kuhn, Duffield, Wis-

tar, T. C. James, Phillip Syng Physick, Gerhard, Pennock, John Syng Dorsey, Nathaniel Chapman, E. K. Kane, Stillé, Harrison Allen, Horatio C. Wood, Louis A. Duhring. Here we find the beginnings of serious work in pathology in the sixties and the beginnings of the specialties in the seventies.

Bellevue (established 1795) and the Massachusetts General (1821) present stories that almost parallel Blockley in historical importance.

Those who are interested in the story of the early development of medical education in America will find two chapters that contain a mass of authentic information on the subject. These chapters are *Medical Education Before the Foundation of Medical Schools* and *the Earliest Medical Schools*. The status of medical education at the outset of the Revolution is quickly described by the statement that there were some 3,500 men in practice in the colonies, of whom only 400 held medical degrees. Here we view the great difficulties under which teaching was performed prior to the establishment of schools. But the absence of schools did not prevent great teachers from imparting knowledge. Among these preschool teachers, Packard gives us intimate pictures of such characters as William Shippen, Daniel Drake, John Bard, Peter Middleton, John Warren and John Collins Warren, John Kearsley, and John Foulke. These men, of course, became eminent faculty members when schools were established.

In some of the earlier schools—Philadelphia College (1749), King's College and its descendants (1768), Harvard (1783), Dartmouth (1796), and Transylvania (1799)—many other characters of fame pass before us: John Morgan, Adam Kuhn, Benjamin Rush, James Tilton, Jonathan Potts, Caspar Wistar, Phillip Syng Physick, William Pepper, Alfred Stillé, Valentine Mott, Elisha Bartlett, James Jackson, Henry and Jacob Bigelow, Cheever, Porter, the Shattucks, Ernst, J. J. Putnam, T. M. Rotch, Nathan Smith, Alexander Ramsey, and Lyman Spaulding.

Three chapters concern the history of military medicine in America. The first of these deals principally with the profession in the Revolution and includes a résumé of the history of the Medical Department of the Army to the end of the Civil War. This chapter is supplemented by a special chapter on the history of the Army Medical Department from the close of the Revolution to the close of the Spanish War, by Col. P. M. Ashburn, Medical Corps, United States Army. Another special chapter, by R. P. Parsons, concerns the history of the Navy Medical Department from the beginning of the Revolution to the beginning of the World War.

A chapter on medical schools founded during the first half of the nineteenth century portrays the rapid appearance of these institutions with the development and western spread of the country and

shows why some of them remained in existence and became great centers of medical learning while others collapsed or merged with stronger schools. This story is not without its glowing biographical brevities, of which the most colorful is that of the peripatetic Daniel Drake.

A chapter entitled "Outlines of Development of Medical Practice and Education in Some of the States" is divided into sections devoted to each of the several States considered, each section being topically divided into outlines of such matters as practice, schools, specialty developments, hospitals, legislation, and medical publications. Many personalities, of course, come into all parts of these discussions.

The chapter that was found most appealing by this reviewer was that on Foreign Influences on American Medicine. Until our schools could provide training as fine as any in the world there were always the groups of serious students seeking this training in the great European centers. Before the Revolution the foreign influence came chiefly from Edinburgh and London, Edinburgh perhaps more than London, not only because our students attended the Edinburgh schools, but also because so many Edinburgh doctors settled in the Colonies.

That Edinburgh had a profound influence is easily seen by noting a partial list of its American products: Morgan, Rush, Kuhn, Wistar, Physick. Many of our ablest early surgeons, notably Valentine Mott, were trained under Sir Astley Cooper.

After 1812 our students went more often to Paris, and later to Leyden, Vienna, Berlin, and other centers. Among the French teachers, Louis was held in greatest esteem by the Americans. In the thirties such men as Holmes, H. I. Bowditch, James Jackson, and Gerhard were attending Louis's clinics and all were writing the most glowing accounts of the great instruction, and, more important, the great inspiration they were receiving from this renowned teacher.

When one has come to the end of this book he feels that he has accomplished a most profitable piece of reading; that he is conversant with what has gone before in American medicine; with the utmost satisfaction he replaces the book on the shelf, knowing that he can enjoy parts of it a hundred times more or can find a concise exposition of any particular era or event with which he may be especially concerned for the moment.

SELECTIONS FROM THE PAPERS AND SPEECHES OF JOHN CHALMERS DaCOSTA,
M. D., LL. D. W. B. Saunders Co., Philadelphia, 1931

Sometimes a great teacher leaves us a legacy by which we may judge his personality, his qualities of courage, his wit, his homage to his teachers and contemporaries. Paré did such with his Apology,

Baron Larrey in his *Memoirs*, while Hunter's manuscripts were burned by his brother-in-law, Sir Everard Home, and were lost to us. Now, through the encouragement of Dr. Harvey Cushing, to whom the book is dedicated, we have in collected form the speeches and papers of one of America's greatest teachers in the field of surgery.

Successively he has filled many positions in the departments of anatomy and surgery at Jefferson College. He was author of the section on dissection in *Nancrede's Anatomy*; collaborator with Hamilton and Packard on *Saunders's Medical Dictionary*; editor of the surgical section in *Gould's Year Book*; American editor of *Zuckerkandl's Operative Surgery*, 1889; editor of *Seventeenth Edition of Gray's Anatomy*; author of articles in *Hare's American System of Therapeutics*; *Warren's International System of Surgery*; *Keen's System of Surgery*; *Oschner's System of Surgery*; editor of a surgical section in *Hare's Progressive Medicine*; and best of all, author of the encyclopedia known as his *Manual of Surgery*. Few books are carried to the tenth edition by an author. Thousands and thousands of medical men throughout the United States sucked the pap of surgery from this volume, and his influence extends far by its sale in European countries, India, in the Far East, Africa, Australia, New Zealand and South America.

In 21 essays rich in historical, biographical, and philosophical material, as well as interesting reminiscences, the book carried us through 440 pages.

Medical Paris during the reign of Louis Philippe is the work of an artist. With quick and vivid strokes he lays before the reader with impressional simile and metaphor the background of Paris—its many hospitals and its brilliant quarreling surgeons. Name after name, event after event, of great medical interest shape and pass through the turnings of each page, but out of the setting come brief gems, sketches of three great Parisian surgeons. The tale of each is told separately and yet is a part of the motive and design of the whole. Dupuytren, Lisfranc, and Velpeau get the spotlight. But there are so many glimpses of men like Boyer, Larrey, Roux, Civiale, Nélaton, Sanson, and others, not to mention their achievements, that one is disappointed at the very beginning that the book has no index to bring out more readily the treasures of medical history and biography which it contains.

The *Trials and Triumphs of the Surgeon* is a delightful review of 30 years' experience as a surgeon, full of philosophy and history and closing with 54 apothegms, aphorisms, and epigrams. They are full of wit. Here are some of them:

Sometimes a man tells the truth out of pure meanness.

Many a man who is brooding over alleged mighty discoveries reminds me of a hen setting on billiard balls.

A fashionable surgeon, like a pelican, can be recognized by the size of his bill.

A surgeon is worried about the past, anxious about the future, and up to his neck in present trouble. Often he suffers from the three afflictions at once and then feels as if he had taken a boil, rheumatism, and religion at the same time.

The first patient I ever had stole my only umbrella. In those days patients regarded "9 to 1" on my sign as a notice of the odds against them.

Because Baron Boyer nearly a century before had written a book on surgery in which he had stated that any notable progress in the art and science of medicine was impossible, DaCosta, in his address before the graduates of the Naval Medical School in March, 1907, showed the conceit of the statement in a review of the remarkable progress that immediately followed, making Boyer's time seem like a blissful period of ignorance. The more fortunate of that class are captains in the Medical Corps now, and each must read this essay with a satisfaction and consciousness that the occasion of his graduation is suitably noticed. This was before the Medical Reserve Corps was created by law, and when the patriotic DaCosta, Hare, Daland, and other notable Philadelphia doctors took commissions in the corps with the low rank of lieutenants, junior grade, subordinate to their very students. This essay is richly philosophic as well as historical. He warned his hearers of the growing dependence upon laboratory methods of diagnosis and its tendency to detract the clinical study. "It is to be an aid, an assistant, an adjunct, a collaborator, if you will, but not as we are rapidly making it, a tyrant and a despot." He paid his tribute to the positive genius for criticism of those persons "who devote themselves entirely to other persons' business." The "antivaccinationists," the "antivivisectionists," the "ultra temperance advocates," who would forbid the use of alcohol in the treatment of disease—persons who forget that drunkenness can not be stopped unless the cause is removed, for no law can be passed that will prevent thirst." There was no serious belief then that prohibition would soon be a fact. And he continues:

There are the diet cranks who would prove by statistics that everything is harmful. It has been pointed out that bread, rice, potatoes cause diabetes; that beef is responsible for tapeworm; pork for trichinosis; that strawberries produce nettle rash; that cucumbers and watermelons induce colic; that grapes, dates, figs, raspberries, and soft-shelled crabs are responsible for appendicitis; that the use of pie and cheese is followed by dyspepsia; of ice cream by tyrotoxin poisoning; of pickles by copper poisoning; of canned goods by lead and ptomaine poisoning; of lettuce by poisoning by opiate; of milk by tuberculosis; of beer by Bright's disease; of alcoholic liquors by liver diseases, and of water by lead poisoning and typhoid fever. In fact, things have come to such a pass that a human being to be safe and virtuous will be obliged to live in what has been called a pious vacuum.

And then in concluding his advice he says:

You should resolve at the very start to learn to observe, to think, to compare, to analyze, to study, to avoid formulas, to cast out sordid thought, to repudiate shallowness, advertising, and vain pretensions; to be originals and not simulacra; to be honest, gallant, patriotic gentlemen, worthy to be priests of Aesculapius and to be officers of the Navy of the United States.

"Dickens' Doctors" any medical man can read with profit and enjoyment. It is not historic, it is not philosophical, but it paints in subtle manner the human weaknesses and virtues which might be possessed by anyone.

His essay on Baron Larrey is a sketch of absorbing interest. The tribute of Larrey to the American surgeons of the Revolution is worthy of note. Larrey pointed out that while the French surgeons had better hospitals and delayed amputations the Americans, with poorer hospitals, amputated early and had a comparatively small mortality. It is a splendid review of surgery in Napoleon's time.

Calling attention to some of the errors of modern medical preparation, we are startled when, in the essay *Certain Tendencies in Medicine* (p. 374), we read:

More of these gifted men come from the farm than from the city, more from the loins of the people than from the shades of ancestral trees, more from the alley than from the boulevard, more from the hovel than the mansion. If our bosses keep on getting their way, such men will soon not be allowed to study medicine at all and only the rich man's son will be permitted to become a doctor. * * * I would like to discuss the conduct of the medical boss, which is gathering strength and power, which would keep a man from studying medicine at a period of life when his mind is plastic and formative, when it is "wax to receive and marble to retain"—which would condemn him to take a college degree before he can take a medical degree, and which, if it gets its way, will keep the son of a poor man from studying medicine in the United States.

Graduates of Jefferson, ex-internes of Blockley could hardly fail to find much to interest them. There are biographical sketches of McClellan, the elder and the younger Gross, W. W. Keen, and of Crawford W. Long. The story of the beginnings of Jefferson is told and we catch glimpses of some of our own early naval medical officers. W. C. P. Barton, the first Surgeon General of the Navy, was the first to attempt to found this school, but the charter was refused. Later he became professor of botany and *materia medica* there and wrote two works on this subject.

The last surgical clinic in old Jefferson and the story of the old operating table will interest all Jefferson alumni. But there are stories of a conversation overheard between Marion Sims and Gross and the story of how he showed Gottstein the sights about Philadelphia, which one has to read to enjoy.

The story of Old Blockley Hospital is a treasure of hospital history of the roaring eighties. This was a time when no respectable

person sought treatment in a hospital. Then it was a refuge for misery and dissolution among paupers and the down and out who were without money or home or friends or rights.

Any young surgeon could read "Behind the Office Doors" with profit. In it he could find cheer and encouragement. Sound sense founded on hard experience. He would get more for his money and something of more lasting benefit than he could obtain from many times the cost of the book spent for tickets to a football game or to see a prize fight. He would learn many things, and among them how the famous Gray's Anatomy was judged by a reviewer in 1859, a book "not wanted," a book "low and unscientific in tone" and "not even up to the mark of existing vade mecums!"

Think of it!

Yet the book proved immortal and DaCosta edited the seventeenth edition. This volume of essays should be owned by every alumnus of Jefferson, and particularly by all those interested in the history of surgery.

THE DIAGNOSIS AND TREATMENT OF BRAIN TUMORS, by *Ernest Sachs, A. B., M. D., Professor of Clinical Neurological Surgery, Washington University School of Medicine, St. Louis.* C. V. Mosby Co., St. Louis, 1931. Price, \$10

This is one of the most admirable productions in medical literature during recent years. The illustrative and printing art of the publishers has added greatly to the value of a book which even without that help would constitute a treasure of the most sound and practicable information on this very important subject, set down in a most readable and understandable form.

Brain tumors are not rare diseases. Every physician may expect to encounter them, should know how to recognize them, and should be intrigued by the rather intricate though quite exact methods of localizing them.

Numerous case histories have been used to illustrate significant points and pitfalls that lead to errors in diagnosis.

The first chapter concerns surgical anatomy and surgical physiology of the nervous system. Unique methods of description are used. In the succeeding six chapters the steps by which a diagnosis is reached are discussed. Chapter VIII concerns differential diagnosis. The final chapter concerns operative technique and postoperative care. There are 224 illustrations, including 6 colored plates. The colored drawings, by Mr. P. A. Conrath, and the colored plates of fundi, by Dr. A. Hopsommer, are beautifully done.

To have placed this much information on less than 400 pages is an achievement for which both author and publisher are to be congratulated.

PRACTICAL CLINICAL PSYCHIATRY FOR STUDENTS AND PRACTITIONERS, by *Edward A. Strecker, A. M., M. D., Professor of Nervous and Mental Diseases, Jefferson Medical College, Philadelphia; Clinical Professor of Psychiatry and Mental Hygiene, Yale University; etc., and Franklin G. Ebaugh, A. M., M. D., Professor of Psychiatry, University of Colorado Medical School; Director Colorado Psychopathic Hospital; etc.* Third edition. P. Blakiston's Son & Co., Philadelphia, 1931

In this new edition a complete revision has been made in order to emphasize further the more important preventive aspects of mental disorders. A new chapter entitled "Practical Aspects of Child Guidance Problems" has been included.

This is an extremely valuable book for general practitioners and for students, as it presents the wide field of psychiatry in an admirably concise and informing fashion.

THE PRINCIPLES AND PRACTICE OF PERIMETRY, by *Luther C. Peter, A. M., M. D., Sc. D., F. A. C. S., Professor of Ophthalmology in the Graduate School of the University of Pennsylvania, etc.* Third edition. Lea & Febiger, Philadelphia, 1931. Price, \$4.50

This is a most admirable monograph, now in its third edition.

It is very concise and shows throughout the extreme care the author has exercised in limiting its matter to discussions and descriptions of vital importance to the ophthalmologist and neurologist.

Among the new matter appearing in this edition should be mentioned the work of Brouwer, Zeeman, and Putnam, which has resulted in the more exact projection of the retinal fibers along the visual pathway; the contributions of Ferree and Rand toward better standardization of equipment and technique; a broader knowledge of the field changes in disease of the nasal accessory sinuses; clearer differentiation of optic neuritis, papillitis, and papilledema; the bearing of perimetry on cerebral localization.

The chapter headings are as follows:

1. Anatomy and Physiology of the Visual Pathway.
2. Physiologic Principles. Normal Fields.
3. Methods. Technique of Field Taking. Instruments. Charts.
4. General Pathology of the Visual Field.
5. Special Pathology of Fields.
6. Fields in Functional Nervous Diseases.

A TEXTBOOK OF LABORATORY DIAGNOSIS, by *Edwin E. Osgood, M. A., M. D., Assistant Professor of Medicine and Biochemistry, Director of Laboratories, University of Oregon, and Howard D. Haskins, M. D., Professor of Biochemistry, University of Oregon, School of Medicine, Portland, Oreg.* P. Blakiston's Son & Co., Philadelphia, 1931

This is a University of Oregon product, a species rather uncommon among medical books. If it is representative of the standard of teaching at the University of Oregon Medical School, the Oregon medical students are to be highly congratulated.

Although designed primarily for teaching and class purposes, it forms an excellent reference and could be widely used by practitioners and laboratory workers. The authors have managed to make it a quite comprehensive treatise in less than 500 pages.

The subject matter is divided into two natural divisions. Part 1 concerns questions of importance at the bedside; which laboratory procedures will be helpful; how often they may be repeated; how they may be interpreted; how they may indicate the results of treatment. Part 2 contains the technical information that must be possessed by the laboratory worker.

The authors have chosen for full description only what they consider the most satisfactory procedures; the others are disposed of by brief but critical discussions.

All but the simplest bacteriological and serological methods have been omitted, the authors recognizing that these subjects are better treated in separate texts.

The very excellent illustrations in color are by Miss Clarice Ashworth.

Part 1 is divided into the following chapters:

Chapter I: Introductory Considerations.

Chapter II: Disorders of the Kidney and Urinary Tract, with Especial Reference to Nephritis.

Chapter III: Disorders of Carbohydrate, Protein and Fat Metabolism, with Especial Reference to Diabetes Mellitus and Disturbances of Acid-Base Equilibrium.

Chapter IV: Pregnancy and its Complications.

Chapter V: Disorders of the Central Nervous System, with Especial Reference to the Differential Diagnosis of Coma.

Chapter VI: Disorders of the Gastro-Intestinal Tract.

Chapter VII: Disorders of the Ductless Glands, with Especial Reference to the Basal Metabolism in Thyroid Disturbances.

Chapter VIII: Hematology.

Chapter IX: Disorders of the Respiratory and Cardiovascular Systems.

CHININ, IN DER ALLGEMEINPRAXIS, by Dr. Med. Fritz Johannessohn. Publisher: Bureau Tot Bevordering Van Het Kinine-Gebruik, Amsterdam-W, 1930

In 1810, Gomes obtained crystals of cinchonin from the *Cortex chinæ*, and this success stimulated two French scientists, Pelletier and Caventou, to isolate quinine from the bark in 1820.

The author believes that the research of recent years indicates the therapeutic value of quinine in many ways other than as an antipyretic or its specific use in malaria.

Following short and interesting chapters on the history, source and production, chemistry, and pharmacology of quinine, the re-

mainder of the book is devoted to the uses of quinine in a considerable variety of conditions.

Despite the author's enthusiasm, he leaves this reviewer still in serious doubt as to the salutary effects of quinine in conditions other than malaria.

The book contains a good portrait of Gomes, Pelletier, and Caventou.

PHYSICS OF RADIOLOGY, by *J. L. Weatherwax, M. A.* Paul B. Hoeber, New York. Price, \$5

This book contains the essentials of a series of lectures delivered to graduate students in radiology at the University of Pennsylvania. It is designed to furnish a convenient manual for radiation therapy, and the minute account of methods of treatment and estimation of dosages, as well as the numerous excellent tables, indicate that no effort has been spared to achieve this purpose.

The first 36 pages are given over to an introduction to the general principles of electricity, the definition of terms, and the statement of electrical laws. This is followed by a brief but excellent summary of the atomic theory and this by a chapter on radium. The general characteristics of the Röntgen rays are then considered at some length, and careful attention is given to their physical properties, biological effects, and the measurements of these effects. The tables given are most valuable, and the methods of estimating the dosage and the procedure to be followed in giving saturation doses are clearly outlined. There is an interesting chapter on the practical technique of using radium.

In the foreword Doctor Pancoast reviews the many advantages which the present-day radiologist has over the pioneers and points out how such modern improvements as the Coolidge tube, the milli-ampere meter; the stabilizer, and the Potter-Bucky diaphragm have lessened the problems of the technician. The work of the X-ray physicist has done much to lessen the problems of treatment, and such works as this tabulate the useful technical knowledge needed by the therapist.

The book is admirably printed and illustrated.

PRACTICAL RADIATION THERAPY, by *I. I. Kaplan, B. S., M. D.* W. B. Saunders Co., Philadelphia, 1931. Price, \$5

This book begins with a brief but interesting historical sketch of both X rays and radium. The mining and chemistry of the latter is also given in some detail.

The next section is devoted to X-ray physics and to a brief description of X-ray apparatus. There are a number of good pictures and diagrams that add to the ease with which the descriptions can be

followed; indeed, the connection between picture and text is unusually good throughout the entire book. The practical methods of applying radium treatments are given considerable attention, and the whole subject of radiation treatment is discussed in a simple but thorough manner. The latter half of the book is given over to the radiation treatment of various pathological conditions in which radium or the X ray have been found of benefit. The case method of teaching is used here, pictures of the lesion being given, and the treatment outlined on the opposite page.

In general, the book represents an excellent elementary and practical work on X ray and radium therapy, and should prove a particularly useful book for the beginner in this field as well as to indicate to the general practitioner the possibilities of treatment with X ray and radium.

AN INTRODUCTION TO PRACTICAL BACTERIOLOGY, by *T. J. Mackie, M. D., D. P. H., Professor of Bacteriology, University of Edinburgh, and J. E. McCartney, M. D., D. Sc., Director of Research and Pathological Services, etc.* Third edition. William Wood & Co., New York, 1931. Price, \$3.50

A handy little pocket-size guide to bacteriological laboratory work, written primarily for the use of students in the University of Edinburgh.

SURGICAL NURSING, by *Hugh Cabot, M. D., O. M. G., F. A. C. S., Senior Consultant, Mayo Clinic, Rochester, Minn., and Mary Dodd Giles, B. S., R. N., Associate Professor of Nursing Education, Vanderbilt University.* W. B. Saunders Co., Philadelphia, 1931

Since the physician has become more concerned with the application of scientific principles to the practice of medicine, the nurse has been taking over many details of the work formerly performed by the physician.

Thus the nurse is more than ever in need of information which will enable her to assume considerable responsibility and to carry out a large amount of work outside the range of simply following the specific instructions of the doctor.

This book is written with this very sensible outlook on modern nursing and will go far in meeting the needs of nurses. It should be of even greater value to graduate nurses than to student nurses.

The authors have very sensibly omitted discussions of certain special subjects in which all nurses receive adequate special instruction during training, such as bandaging and obstetrical and gynecological surgical nursing.

There is an unusually full discussion of the principles of urologic surgery because of the many changes in this work during the last generation and because the subject has been too neglected in the teaching of the principles of surgery to nurses.

A MANUAL OF THE COMMON CONTAGIOUS DISEASES, by *Philip Moen Stimson, A. B., M. D., Associate in Pediatrics, Cornell University Medical College; Attending Physician, Willard Parker Hospital, etc.* Lea & Febiger, Philadelphia, 1931. Price, \$3.75

This book is of convenient, almost pocket, size with flexible binding.

It is intended primarily as a clinical guide for medical students and internes, but should also be a valuable aid to nurses working with contagious diseases. It might also be found of distinct use by general practitioners, pediatricians, and particularly doctors serving as school physicians.

There are chapters on the principles of contagion, serum reactions, vaccination against smallpox, and general management of contagious diseases, and in separate chapters are discussed in a very readable and complete and enlightening manner the following diseases: Diphtheria, Vincent's angina, scarlet fever, measles, rubella, whooping cough, mumps, chicken pox, epidemic meningitis, and poliomyelitis.

LOVETT'S LATERAL CURVATURE OF THE SPINE AND ROUND SHOULDERS. Edited by *Frank R. Ober, M. D., Assistant Professor of Orthopedic Surgery, Harvard University, and A. H. Brewster, M. D., Instructor of Orthopedic Surgery, Harvard University.* Fifth edition. P. Blakiston's Son & Co., Philadelphia, 1931

This book, now in its fifth edition since 1907, is dedicated to the memory of the author of the earlier editions.

Many changes have occurred in our knowledge of the etiology of scoliosis and in methods of treatment, even since the previous edition. In this edition Galeazzi's method of treatment has been added and the turnbuckle jacket described. The chapter on exercises has been rewritten.

The book makes a very complete monograph, including a most interesting chapter on the history of scoliosis.

FRACTURES AND THEIR COMPLICATIONS, by *George Ewart Wilson, M. B. (Tor.), F. R. C. S. (Eng.) F. A. C. S., Surgeon-in-Chief, St. Michael's Hospital, Toronto; Assistant Professor of Surgery, University of Toronto, etc.* The Macmillan Co., New York, 1931

This book is, above everything else, a modern treatise on the subject of fractures. No space is wasted on methods of treatment which have been or are being replaced by the more highly approved methods of the present day. The author believes that the value of reduction with the fluroscope is so great "that the time is not far distant when it will be just as necessary to set most fractures by the aid of fluroscopic vision as it is now considered obligatory to confirm the reduction by an X ray."

After five chapters on general considerations of fractures with a very able discussion on such subjects as repair, pathological fractures, compound fractures, and physiotherapy, the rest of the book is divided into chapters on fractures of the different bones.

While the subject is covered in an exhaustive way and the book is abundantly illustrated, the author has been able to condense all the useful newer knowledge of the subject into some 400 pages.

The extreme practical value of the book should give it a high place among the modern texts on fractures.

THE ANTIQUITY OF HINDU MEDICINE AND CIVILIZATION, by *D. Chowry Muthu, M. D., M. R. C. S., L. R. C. P. Lond., Associate of King's College, London.* Third edition. Paul B. Hoeber, Inc., New York, 1931. Price, \$1.50.

Those who think there was never anything new under the sun, even in early Egyptian and Assyrian times or among the early Greek thinkers, should read this fascinating little survey of the civilization in India at a period as early as 7000 to 9000 B. C.

Much of our present knowledge of this ancient civilization has come from the recent excavations of Sir John Marshall and recent interpretations by Sanscrit scholars.

The Atreya Samhita, containing 46,500 verses, is the oldest existing work in medicine, and reveals that in the Rig Veda period (4000-2500 B. C.) the Aryan civilization anticipated the essentials of a large part of the various branches of modern medical science and the other sciences.

The works of Charaka and Susruta remained standard medical works for many centuries, being first written in the epic period (2500-600 B. C.) and perpetuated by revisions and re-editings down to 1550 A. D. From these works we find that nearly all modern surgical instruments are but slight modifications of those in use by the ancient Hindu surgeons.

Bhava Misra, in 1550, mentions the circulation of the blood a century before Harvey.

India was indeed the cradle of Aryan civilization. The secret of this great civilization perhaps lies in the appreciation of that ancient people that man is a spiritual being; for the ideal of the ancient Hindu physician was to save humanity regardless of earthly gain. Charaka expressed this ideal in a way that anticipates the Hippocratic oath by some centuries: "Not for self—not for the fulfilment of any earthly desire of gain, but solely for the good of suffering humanity, should you treat your patients, and so excel all. Those who sell the treatment of disease as merchandise gather the dust and neglect the gold."

The latter half of this book, now in its third edition, concerns such phases of the ancient Hindu civilization as racial, educational, literary, scientific, and philosophical.

THE BELOVED PHYSICIAN, SIR JAMES MACKENZIE, by *E. McNair Wilson*. The Macmillan Co., New York. Price, \$2.50

This is a personal intimate story of the humble young man who revolutionized our understanding of heart disease and became the great Mackenzie. The personal human appeal of the story will be enjoyed by the layman. The physician will feel all this appeal even more than the layman, and in addition will receive from this book a fine account of the development of our understanding of heart function and heart disease. The physician will find here an inspiration—carried from Mackenzie, through his biographer, to the pages of the book—that will make his relations with patients less of a humdrum affair and his outlook on medicine one that is warmer, livelier, more hopeful.

Mackenzie "was not as other men. * * * He loved that great profession which he so signally adorned with a great and passionate love, was jealous of its honor, bold in its defense. But he saw the weaknesses which beset it and raised his voice to warn it of its danger."

PHYSIOLOGY, by *John F. Fulton, M. D., Sterling Professor of Physiology, Yale University*. Paul B. Hoeber (Inc.), New York, 1931. Price, \$1.50

The Clio Medica series and its distinguished editor, E. B. Krumbhaar, are to be highly congratulated on the appearance of this splendid work of John Fulton's, for this very skillfully arranged history of physiology outshines even the excellent members of the series that have preceded it.

Fulton's interest in the history of his subject must be not far behind his great absorption in the subject itself. The reader quickly catches this interest and much of the author's inspiration in following the development of this foundation stone of the science of medicine.

The author has added much to the readability of the book by weaving into the story of the development of the science considerable information on the personal side of the leading workers.

Following a short chapter on the Ancients, which chiefly concerns Galen, the main body of the book is divided into three chapters—circulation, respiration, and digestion.

The chapter on circulation leads us through the lives and works of such notables as Servetus, Canano, Fabricius, Harvey, Borelli, Lower, William Cole, Bellini, Leeuwenhoek, Stephen Hales, Malpighi, Swammerdam, and Bartholin.

Biographical material of particular importance and interest is given in the cases of Harvey, Malpighi, and Leeuwenhoek.

The chapter on respiration concerns largely the works of Robert Boyle, Robert Hooke, Lower, Mayow, Priestley, and Lavoisier.

In the chapter on digestion one is reminded of the great contribution that may be made by one who inspires students. An illustrious example is found in the case of Franciscus Sylvius, who, though he contributed little himself, was the teacher and inspirer of such a galaxy as Stenson, Swammerdam, de Graaf, and Vieussens.

The characters chiefly dealt with in the chapter on digestion are Van Helmont, Franciscus Sylvius, de Graaf, de Réaumur, Spallanzani, John Hunter, Beaumont, and Claude Bernard.

A chapter on the Rise of the Teaching Laboratories tells of the establishment of physiology as a part of the medical curriculum (for the first time in history) at the Medical Institute of Edinburgh, Andrew Sinclair being the first professor. The great English teachers to follow him were William Sharpley, Richard Quain, and Michael Foster.

Meanwhile, on the continent, the famous meeting of Helmholtz, Ludwig, du Bois Reymond, and Brücke in Berlin in 1847 resulted in the work which "caused physiology to become the science that we now know."

In the United States, Benjamin Rush may be regarded as the first American physiologist, although the first American laboratory was not established until that founded by Henry Pickering Bowditch at Harvard in 1871, and which has been directed by W. B. Cannon (who succeeded Bowditch) since 1906.

An epilogue concerns the trend of modern physiology, and the appendix translates Claude Bernard's conception of the term "general physiology."

The frontispiece is the portrait of Claude Bernard, which hangs in the Faculté de Médecine, Paris.

FADS, FRAUDS, AND PHYSICIANS, by *T. Swann Harding*, Lincoln Mac Veagh, The Dial Press, New York, 1931

This book is an exposition of the many faults that are to be found in the practice of medicine. Mr. Harding finds fault with almost every phase and feature of modern medical practice, from the more strictly professional aspects of examining, diagnosing, and treating patients to the economic considerations, medical ethics, medical politics, hospital administration, etc.

While the medical man will find in this book practically nothing that he did not already know, he will find nothing untrue, and he may here be reminded in a rather exact and forceful and perhaps beneficial way of the many shortcomings of his profession.

For the layman the book may be something of a revelation, and in the enlightenment it may bring to the lay public it constitutes a potentially powerful stimulus to the elevation of the standards of the various phases of medical practice.

So long as the public demands humbuggery and is satisfied with mediocrity in medicine it will be plentifully supplied with such. This book, like many an article on related subjects in recent popular magazines, points toward the increasing demand that is coming for medicine that is intelligent and scientific and humane and honest and not unduly expensive.

Whether state medicine is the answer, no one can say. But certainly the present trend in the direction of state medicine is a natural and unavoidable process, and can only be expected to continue unless the profession looks to its faults and accomplishes some thorough, perhaps radical, house cleaning.

My sharpest adverse criticism of the book is that the author's perspective is seriously distorted. He portrays a condition that is almost all bad and little good, when we all know that with all their enormous and detestable faults the practice and profession of medicine contain and perform more that is fine and commendable and helpful to mankind than can be found in any other field of human endeavor.

CANCER, by *Willy Meyer, M. D., Consulting Surgeon to the Lenox Hill and Postgraduate Hospitals, New York Infirmary for Women and Children, etc.*
Paul B. Hoeber (Inc.), New York, 1931. Price, \$7.50

It would be comforting indeed if one could easily acquire the optimism of Doctor Meyer in contemplating the cancer problem. Yet much of the book is convincing, and if one can accept the author's surmises and views, as a serious reading of the book is apt to make one do, he is forced to agree with the author that "the outlook appears to be promising, even in advanced cases, for the treatment of all sorts and conditions of cancer." Meyer's optimism is not the optimism that goes with the blissful ignorance of the uninitiated but an optimism which has developed during many years of personal clinical experience and a critical reading of a vast cancer literature. This experience and literature have shown him certain paths which he believes are hopeful paths.

The book, in fact, is "an experiment in path finding." It departs from the conventional pattern of medical texts and departs from many conventional viewpoints on cancer.

A viewpoint has now been gained without resort to extraordinary assumptions, the whole argument being based on common medical conceptions, from which the factors—incessant cell multiplication, cell motility, cell accumulation and, as embodying all three, tumor growth—appear not as autonomous, anarchic, unaccountable, mysterious phenomena, but as the enforced reaction of cells to changes in their environment.

Meyer's present conception of cancer is that it is of twofold nature, a systemic disease and a proliferative process.

If the underlying feature is inherited, "the lesion is believed to consist in an anatomical malformation of the sympathetic nervous

system * * *; if acquired, in an induced weakness of the sympathetic nervous system, leading to functional disturbances. * * * In both instances the imbalance of the sympathetic and parasympathetic (vagus) nervous systems produces vagotonia."

This results in a nervous-glandular-electrolyte imbalance, the imbalance being the underlying factor in cancer predisposition.

Meyer believes that on the basis of hyperalkalinity of the serum, local chronic irritation sets proliferative processes in motion. Explanations will be found in the book as to how these processes become incessant and progress from hyperplasia to self-perpetuating malignancy.

On the basis of Meyer's surmises, the royal road to cancer therapy lies in the production of clinical acidosis. "This will cleanse his whole system permanently of everything pertaining to cancer, viz, susceptibility, tumor, disseminated cancer cells and metastases." Cases are cited confirming these deductions, and means to produce the desired degree of acidosis are discussed.

Whether one agrees with the author's views or not, one can find stimulating reading on each of the 400 pages of this book, not to mention many possible hints that may well lead some day to a complete solution of the cancer problem.

One of the finest features of the book is the number of splendid photographs of deceased scientists renowned in cancer work. These portraits include Rudolph Virchow, Johannes Fibiger, Katsusaburo Yamagiwa, Johannes P. Müller, Roswell Park, Harvey Russell Gaylord, Erwin F. Smith, Jacques Loeb, Marin Théodore Tuffier, Ernest Francis Bashford, and Bertie Ronald Gordon Russell.

CLINICAL ALLERGY, PARTICULARLY ASTHMA AND HAY FEVER, MECHANISM AND TREATMENT, by *Francis M. Rackemann, M. D., Physician to the Massachusetts General Hospital; Instructor in Medicine, Harvard Medical School, Boston, Mass.* The Macmillan Co., New York, 1931

Although our present knowledge of the mechanisms involved in the conditions classed under the general term of allergy may be quite imperfect and far from having arrived at a satisfactory stage of development, it has at least reached a point where it can be put to enormous use in the relief of a large portion of patients who suffer from such conditions.

A veritable avalanche of literature on the subject has been produced, and the present seems none too early for a critical analysis of the immense number of observations on the various phases of this complex problem that have come from the leading clinics of the world.

Doctor Rackemann, whose experience with this class of disorders at the Anaphylaxis Clinic of the Massachusetts General Hospital has placed him in a probably unequaled position of authority on the

subject, has here undertaken a digest of the literature, pointing out the sequence of new observations leading to our present knowledge, and correlating some of these observations with the findings of the Massachusetts clinic.

To many a busy practitioner the entire subject with its complex and esoteric terminology stands as a rather mysterious maze, and to such benighted ones we highly recommend the four pages of condensed enlightenment found in the foreword by Professor Zinsser.

As Professor Zinsser has aptly remarked, this book should bring "the immunological point of view to the clinician and the clinical point of view to the immunologist."

Divided into two major parts—The Phenomenon of Hypersensitiveness; and the Clinical Manifestations of Allergy—the book covers most comprehensively every conceivable corner of this large subject.

THE CLINICAL INTERPRETATION OF BLOOD EXAMINATIONS, by *Robert A. Kilduffe, A. B., A. M., M. D., F. A. S. C. P., Director, Laboratories, Atlantic City Hospital, etc.* Lea and Febiger, Philadelphia, 1931. Price, \$6.50

This should be a book of extreme value to the laboratory specialist as well as the clinician.

It is a very well organized, well written, and thorough treatise on the interpretation of blood examinations.

The first two chapters concern the physical properties of blood and the subject of blood formation and destruction. The remaining 11 chapters deal with laboratory examinations and clinical interpretations in the fields of blood cytology, bacteriology, serology, parasitology, and chemistry.

SURGICAL EMERGENCIES IN PRACTICE, by *W. H. Crompton, M. A., M. B., M. Ch. (Cantab), F. R. C. S. (Eng.), F. R. S. (Edin.), Surgeon to and Lecturer in Surgery at St. Thomas's Hospital, etc., and Philip H. Mitchiner, M. D., M. S. (Lond.), F. R. C. S. (Eng.), Surgeon in Charge of out-patients, Teacher of Operative Surgery and Demonstrator of Anatomy, St. Thomas Hospital, etc.* William Wood & Co., New York, 1931. Price, \$8

This is one of several books on emergency surgery which have appeared during the last year or two. In this type of book one can of course find more readily than in a general surgery information on questions concerning emergency work.

The authors have included all surgical conditions which require active treatment within 48 hours.

The main features of operative technique are given. Clinical signs and differential diagnosis are included, but, quite wisely in such a work, the pathological side and other details and minutiae have been omitted.

A MANUAL OF SURGERY, by *Francis T. Stewart, M. D., Formerly Professor of Clinical Surgery, Jefferson Medical College; Surgeon to the Pennsylvania Hospital; and Walter Estell Lee, M. D., Professor of Surgery, Graduate School of Medicine, University of Pennsylvania, etc.* Sixth Edition. P. Blakiston's Son & Co., Philadelphia, 1931

This book has so many commendable features that it is easily entitled to a place among the three or four books which make up the total of what can be considered the best American 1-volume works on general surgery.

In some 1,300 pages and with the aid of 787 illustrations of the first order the book covers the entire field of surgery, including a most adequate treatment of certain special fields, such as orthopedics, gynecology, and urology.

It is a superb manual which has held fast to the late Doctor Stewart's desire to keep it "stripped of verbiage and unessentials." This new edition makes it a complete guide to present-day surgery.

The section on anesthesia includes the essential information on all the later advances in this field.

The chapter on nerves has been entirely rewritten and the old illustrations for this chapter have been replaced by original drawings.

The chapter on bones has been rewritten and more adequately illustrated.

Much of the subject matter for the chapter on the thyroid has been contributed by Pemberton, of the Mayo Clinic, and Crile, of the Cleveland Clinic.

Dr. Chevalier Jackson and his son have revised the chapter on the respiratory system.

Several other chapters have been revised by leading authorities on the respective subjects.

THE PATHOLOGY OF INTERNAL DISEASES, by *William Boyd, M. D., M. R. C. P., Ed., Dipl. Psych., F. R. S. C., Professor of Pathology in the University of Manitoba; Pathologist to the Winnipeg General Hospital, Winnipeg, Canada.* Lea & Febiger, Philadelphia, 1931. Price, \$10

While there is no good reason for the appearance of a large portion of the new medical books that are placed on the market each year, many or most of them offering nothing new in the way of material and exhibiting no changes in presentation that are in any sense improvements over the better works already published, some few stand out in the annual flood of several hundred in the United States because they do contain new and valuable matter and because they present their subjects in a form that meets the desires and needs of the reader.

Boyd has just contributed a book of this latter small class which makes a worthy mate and something of a supplement to his Surgical Pathology. (See the BULLETIN, October, 1929, p. 733.)

There are about 900 pages and 300 illustrations that bring to the reader much sound and modern information on the pathology of nonsurgical diseases.

Boyd is an able teacher and his writing bears every evidence of this.

The book is written largely from the point of view of the mechanism of disease, rather than from that of diagnosis or cure. The relation of symptoms to lesions concludes the discussion of every subject of importance. In this book the student or physician can follow what Galton has called "the steady and pitiless march of the hidden weaknesses in our constitution through illness to death." Much emphasis and space is given to considerations of pathological physiology, especially in the discussion of such organs as the kidneys, pancreas, thyroid, and parathyroids.

THE PRINCIPLES OF BACTERIOLOGY AND IMMUNITY, by *W. W. O. Topley, M. A., M. D., M. S. C., F. R. C. P., Professor of Bacteriology and Immunology, University of London, etc., and G. S. Wilson, M. D., M. R. C. P., D. P. H., Reader in Bacteriology and Immunology in the University of London, London School of Hygiene and Tropical Medicine.* William Wood & Co., New York, 1931. Price, \$15.

This work consists of 1,300 pages of reading material divided into two volumes. The entire subject is taken up under four headings or parts, namely, General Bacteriology, Systematic Bacteriology, Infection and Resistance, and the application of Bacteriology to Medicine and Hygiene.

The authors treat this difficult subject in a most thorough and systematic manner. They have also adopted the newer nomenclature of bacteria as now widely used in the United States and fostered by the Society of American Bacteriologists. Little space, however, is given to technique.

These volumes would grace the shelves of any medical library or clinical laboratory. Part IV, dealing with the application of bacteriology to medicine and hygiene, could well be read by any naval medical officer.

The volumes are well bound in blue-gray buckram.

ABDOMINO-PELVIC DIAGNOSIS IN WOMEN, by *Arthur John Walscheid, M. D., Director of Obstetrical and Gynecological Department of Broad Street Hospital; Director of Obstetrical and Gynecological Department of Pan American Medical Center and Clinics, New York City, etc.* The C. V. Mosby Co., St. Louis, 1931. Price, \$12.50

When a thousand pages of text and 397 illustrations are used in a treatise limited strictly to the diagnostic aspect of gynecology, one is justified in calling the book an exhaustive monograph.

It is divided into a general and special section, the former dealing with general causal factors, pathologic processes, symptoms, and diagnosis, while the latter considers the special organs from the standpoint of diagnosis.

There are numerous clinical histories. These are taken from the writings of several other eminent gynecologists as well as from the author's cases, and demonstrate not only the usual course of procedure, but also the many pitfalls in diagnosis.

The chapter headings are as follows: Etiologic Factors; General Symptomatology; Gynecologic Examination and Diagnosis; Diseases of the External Genitals; Diseases of the Vagina; Diseases of the Cervix; Diseases of the Uterus; Diseases of the Tubes; Diseases of the Ovaries; Diseases of the Pelvis; Diseases of the Urinary Tract; Diseases of the Abdominal Wall and Viscera; and Diseases of the Anus and Rectum.

While it is impossible to enter here into any detailed discussion of the merit or special features of a book of this size, this reviewer is constrained to remark that the book will be found an enormous aid to the post-graduate student or to the general practitioner who frequently faces problems in gynecologic diagnosis.

THERAPEUTICS MATERIA MEDICA AND PHARMACY, by *S. O. L. Potter, A. M., M. D., M. R. C. P. Lond., Formerly Professor of the Principles and Practice of Medicine in the Cooper Medical College of San Francisco, etc.* Fifteenth Edition. P. Blakiston's Son & Co., 1931

This is an encyclopedic work, now in its fifteenth edition.

In a thousand pages the author has condensed, in a ready reference form, all the important material in the fields of materia medica, pharmacy, and therapeutics.

It should be of distinct service to the busy practitioner.

Much new material has been added and much obsolete material deleted. The official preparations of the *Materia Medica* have been brought into conformity with the tenth revision of the United States Pharmacopœia and the fifth edition of the National Formulary.

TRAUMATOTHERAPY, THE TREATMENT OF THE INJURED, by *John J. Moorhead, B. Sc., M. D., F. A. C. S. (D. S. M.), Professor of Surgery and Director, Department Traumatic Surgery, New York Post-Graduate Medical School and Hospital, etc.* W. B. Saunders Co., Philadelphia, 1931

During the last decade or two great stimulus has been brought to the field of traumatic surgery by the war, by the expansion of industrial surgery with the increasing use of machinery, and the great frequency of automobile accidents.

This volume of some 600 pages follows the author's *Traumatic Surgery*, the first edition of which appeared in 1917.

The technic of treatment is given in sufficient detail for all the usual and most of the unusual effects of trauma. The illustrations are excellent, are well chosen, and are an important help in giving the reader a more complete understanding of the text.

The book is well put together, with all sections of the subject adequately covered and space allotted according to the importance of each. Thus there are more than 200 pages given to the chapter on fractures.

If a practitioner were limited to one volume for aid in his traumatic work he would make a wise choice in the selection of this book.

MODERN SURGERY, by *John Chalmers DaCosta, M. D., LL.D., F. A. C. S., Samuel D. Gross, Professor of Surgery, Jefferson Medical College, Philadelphia Surgeon to the Jefferson Medical College Hospital; formerly commander, Medical Corps, U. S. N. R. F., etc. Assisted by Benjamin Lipshutz, M. D., F. A. C. S., Surgeon to the Mount Sinai Hospital; Associate in Neuro-anatomy, Jefferson Medical College, etc.* Tenth edition. W. B. Saunders Co., Philadelphia, 1931

The first edition of this book appeared in 1894. In the nine editions which have followed during the past 35 years the book has advanced in value in proportion to the advances of surgery.

For many years it has been the standard surgical work on the Navy Supply Table and is thus well known to naval medical officers.

In this edition, containing some 1,400 pages and 1,050 illustrations, all the chapters have been revised except that on bronchoscopy by Dr. Chevalier Jackson.

OPERATIVE OBSTETRICS ON THE MANIKIN, by *Charles B. Reed, M. D., F. A. C. S., Associate Professor of Obstetrics, Northwestern University Medical School, Chicago, etc.* P. Blackiston's Son & Co., Philadelphia, 1931.

This concerns principally the mechanics of labor and the technique of delivery in the various presentations and complications. Other obstetrical matters are included in condensed form. The illustrations are admirable. The book should be of especial value to medical students and obstetrical internes.

PYE'S SURGICAL HANDICRAFT, Edited by *H. W. Carson, F. R. C. S. (Eng.), Late Senior Surgeon, Prince of Wales' General Hospital, Tottenham; Lecturer on Abdominal Surgery, North-East London Post-Graduate College.* Tenth Edition. William Wood & Co., New York, 1931. Price, \$7

The antique title of this book will be well understood when it is recalled that the first edition appeared nearly 50 years ago.

It still remains a work on handicraft, the matter being almost entirely limited to information on the technic of treatment. It covers every field of general surgery and the surgical specialties,

and thus the subjects are discussed in a quite condensed form in these 600 pages, and the pattern of the book remains close to that in vogue many years ago.

A SYNOPSIS OF THE UNITED STATES PHARMACOPŒIA AND NATIONAL FORMULARY PREPARATIONS, by *H. J. Fuller, Ph. C., Phm. B., Assistant Professor of Pharmacy, The Connecticut College of Pharmacy, New Haven, etc.* P. Blakiston's Son & Co., Philadelphia, 1931

This book gives in about 200 pages the essentials of the United States Pharmacopœia and the National Formulary. It appears to be especially useful to students who desire this matter in concise form.

THE DIVISION OF PREVENTIVE MEDICINE

Capt. W. H. BELL, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

EFFECTS OF SUPER-HIGH-FREQUENCY RADIO CURRENT ON HEALTH OF MEN EXPOSED UNDER SERVICE CONDITIONS

By W. H. Bell, Captain, Medical Corps, United States Navy, and D. Ferguson, Lieutenant Commander, Medical Corps, United States Navy

In accordance with the request of Naval Operations, an investigation of the effects and possible hazards of exposure to super-high-frequency radio currents was taken up by the Bureau of Medicine and Surgery in July, 1930. The basis of the request was the occurrence of certain subjective symptoms among exposed employees at the Naval Research Laboratory, Bellevue, D. C., in testing the powerful radio machines fabricated there.

A number of individuals and institutions outside of the Government have been interested to follow up the reactions to super-high-frequency induced currents which have been observed in man. They have been alert, of course, for any untoward effects, but the primary object of their investigations, with a few exceptions, has been to determine the therapeutic value of the agency. While duly interested in possibilities in this direction, the requirement assumed for the moment by the Medical Department of the Navy was the determination of any danger to the engineering research and development force at the Naval Research Laboratory and, by inference, to exposed operators of powerful machines installed on ships of the Navy.

The investigation was directed to this side of the problem and resolved itself into the following questions concerning possible effects resulting from multiple moderate or extreme exposures:

- (a) As an extension of the known immediate reactions, is there any cumulative disturbing change in normal physiologic function?
- (b) Is any catabolic chemical change stimulated?
- (c) Is any acute or chronic degenerative biologic process initiated?
- (d) Can observed results, if any, of animal experimentation be translated into terms of the consequences of probable human exposure?

(e) Can adequate safeguards be erected against such exposure if shown to be attended by hazards?

The conclusions are the result of carefully conducted observations of engineering, research, and development personnel under exposure at the Naval Research Laboratory, of a study of the accumulated literature on the subject, of consultation with various scientists (direct and by correspondence) relative to recent unpublished work and opinion, and of animal experimentation. The employment of animals was desirable and, indeed, important to reasonable conclusion, and this was the time-consuming part of the investigation.

The machines now tested at the Bellevue Laboratory in radio communication research develop power up to 20 kilowatts and 80,000,000 cycles per second. The personnel is normally exposed in this work to an electro-static and inductive field which is unmeasurable with any accuracy.

In this connection, Dr. W. R. Whitney, of the General Electric Co., says of their investigation at Schenectady, N. Y.: "With those fields which were not intentionally arranged to give maximum heating effect there was only something like 1° rise in body temperature observable. It was only when we intentionally made the apparatus in a form containing two large condenser plates that we raised the temperature of human beings and of animals by placing them between the plates." With the use of one antenna, which in effect is that which obtains under working conditions at the Naval Research Laboratory, the resultant is not a condenser field in the ordinary sense, and even in a resonance circuit provided by two condenser plates the inductive part of the circuit has such capacitance that an ammeter will not indicate accurately "the actual amount of current flowing in different parts of the inductance." However, for the purpose of tests at the Naval Research Laboratory the aim was to reduce variability in focus and intensity of field while in other respects to simulate the extreme limit of normal conditions, but it was impossible with human subjects (volunteer laboratory personnel) to employ the utmost intensity or prolong the period under repeated exposures to the desired extent. By exposing animals in a definite field under accurately controlled conditions of current strength, wave length, frequency and seance-time factors over prolonged periods of repeated interval exposures, such immediate or cumulative and remote pathological effects as might result would be available for definite reading.

The Carnegie Institution of Washington, D. C. (department of terrestrial magnetism) expressed its readiness to cooperate in the animal part of the investigation, and through its representation by

Drs. M. A. Tuve and W. G. Whitman, who were interested in the subject and equipped for the purpose, contributed splendid assistance. By this means the limitation in the resources of the Naval Research Laboratory and the Naval Medical School laboratories were completely and satisfactorily compensated.

The symptoms occurring in the personnel as a result of exposures normal to an ordinary day's work in the electrical field induced by the operation of the powerful radio machines at the Naval Research Laboratory and elsewhere are reported as headache, fever, lowered blood pressure, dizziness, drowsiness, and fatigue, all of slight though varying degree. The physiological effects of currents of lower frequency, such as diathermy, are well known. Essentially these alternating currents produce only moderate temperature elevations, due to the electrical resistance of the body, confining themselves in their action, according to Loomis and Christie (5), "almost solely to the extracellular fluids," whereas high frequency "currents actually penetrate the living cell * * * by reason of the thinness of the dielectric layer surrounding the cell, which transmits the current by means of its capacitance. The heat produced at these frequencies can be wholly accounted for on the basis of ohmic resistance and dielectric loss."

The physiological effects of super-high-frequency currents have not as yet been thoroughly investigated, but much has been done and is in progress. Schereschewsky (1) reports the destruction of tumors of experimental mouse sarcoma. Carpenter and Boak (2) report the cure of 21 rabbits that were intratesticularly inoculated with syphilis by repeated exposures in which the body temperature was raised to 103°–106° F. They also noted that the animals seemed to become more tolerant to exposures as suggested by delayed reaction in successive treatments. Schaible and Knudsen (3) have studied the blood chemistry of dogs exposed to super-high-frequency currents and conclude that the only effects are those due to hyperpyrexia.

Schereschewsky (4), Christie and Loomis (5), and Carpenter and Page (6) concur in this view. On the other hand, Tuve and Whitman (7), using extremely high-power exposures, giving a rate of 1° C. per minute in general temperature rise, have produced a complete soft tissue destruction in the hind limbs of cats. Their preliminary findings indicate that this result was not in the nature of a burn, for there were no characteristic surface manifestations of such action and the destructive process did not show itself until three or four days after the exposure. They believe, however, that it is probably a somewhat delayed expression of an actual heat effect concomitant with exposure involving the trophic control of the parts concerned, in the neurons of which there may be either a production

or accumulation of greater heat relative to other tissues as a consequence of differences in response to thermic regulation or a greater susceptibility to heat effects. They think it possible also that the actual rate of rise of temperature is an important factor. In his various experiments, Schereschewsky (1), (4) also observed tissue destruction of a necrotic character ranging from superficial skin reactions with alopecia and the formation of a small eschar, which, coming away, left an area of healthy skin, to deeper and permanently destructive sequelæ such as the loss of anatomical parts (ear and tail) in a process of necrosis or dry gangrene preceded by flushing, cynaosis, and hemorrhagic (ecchymotic) areas along the course of the blood vessels. Mellon et al (8) have reduced the potency of diphtheria antitoxin to a twenty-fifth and have proved that this change is not a temperature effect.

The super-high-frequency transmitters used by all of the above investigators, except Whitman and Tuve, have been of 500-watt power and frequencies from 155,000,000 to 60,000,000 cycles per second.

THE PHYSIOLOGICAL EFFECTS OF HIGH TEMPERATURES

The excellent monograph of E. E. Smith (9) on heat stroke contains the following summaries:

1. Optimum atmospheric working conditions are: Temperature 68° F., relative humidity 50 per cent, 45 cubic feet of air per person per minute.

2. The body heat is lost by conduction, by convection, and by radiation.

Conduction increases with humidity.

Convection increases proportionately to the square root of wind velocity.

Radiation is proportionate to the difference between the temperature of the body and that of the surrounding air.

3. Chilling produces an anhydremia with loss of fluid from the blood to the tissues. Heating produces hydremia with absorption of fluid from the tissues.

4. Hot baths (110° for 15-30 minutes) cause a pulse rate of 160, a mouth temperature of 102-104°, a systolic blood pressure of 60 mm. hg., and a fall in alveolar CO₂ tension with corresponding rise in O₂ tension, permitting subject to hold his breath two and one-half times longer than normal.

5. With wet bulb-at 96° F. (35° C.) in a ventilated space the reactions are (1) sense of warmth, (2) at onset of perspiration a general relaxation and sense of drowsiness, (3) with rectal temperature of 99.5° F. a definite change to wakefulness, with irrita-

bility and restlessness. At 103° F. the irritation is exaggerated. At 106° to 108° coma, delirium, and convulsions occur.

6. Dark skins absorb more heat than light skins and they respond more promptly with perspiration and a resulting fall in skin temperature.

7. In heat exhaustion in dogs the following occur: (a) Fall in alkali reserve, (b) decrease in pH of blood, (c) blood lactic acid increases 300 per cent, (d) moderate elevation of nitrogenous elements, ascribed to increased production rather than to retention.

8. In temperatures just above normal, changes in nerve cells have been observed and the lipoids lose their anisotropy. In body temperatures above 107° F. (42° C.) changes occur in Nissl's granules, and if the temperature is maintained coagulation of the nerve cell occurs. Structural changes occur in the anterior horn cells which are ascribed to physico-chemical disturbances because these lesions can not be reproduced post-mortem by temperatures of 112° F.

9. Muscle cramps, including deaths of cardiac origin, are ascribed to localized tetany with accompanying derangement of the calcium metabolism.

THE SUPER-HIGH-FREQUENCY RADIO TRANSMITTER

The electrical field surrounding the super-high-frequency transmitter at the Naval Research Laboratory produces some interesting effects. It is possible, for example, to illuminate the filament of an ordinary incandescent bulb held in one's hand at a distance of some 20 feet from the machine, the necessary electrical energy being absorbed by the body, which acts as an antenna. This absorbed electrical energy is first felt in the extremities, and a stay of several minutes in the vicinity of the machine is followed by unpleasant warmth and sweating of the feet and legs. Continuing in the electrical field general body warmth and sweating, drowsiness, headache, pains about the ankles, wrists, and elbows, weakness, and vertigo occur in the order named.

The men at the Naval Research Laboratory who volunteered to submit to super-high-frequency exposure under medical observation, were asked to take as much exposure as they felt that they could with safety. The standard procedure adopted for conducting the observation on the volunteer was as follows: The man undergoing examination stood about 4 feet from the machine in an area where the maximum electrical effects were felt. Although standing, he was kept in a state of rest as far as consistent with the posture in order that the effect of the exposure per se might not be falsified by the influence of physical activity. As symptoms apparently did not develop as rapidly when the subject stood at comparative

rest in the electrical fields as when he was working, the technical staff devised an antenna to augment the electrical effects. The antenna was a metal rod about 40 inches long and 1 inch in diameter and was held in one hand by the subject. This rested on a steel fence, which absorbed and transmitted additional current. For convenience in this report the hand holding the antenna is referred to as the antenna hand.

An ordinary clinical thermometer was kept under the tongue and frequent readings made.

The skin temperatures were recorded with spirit thermometers.

A single exposure producing fever and one or more other symptoms was given to three of the volunteers; one volunteer had three daily exposures and two had five daily exposures. The repeated exposures were made on consecutive days.

INVESTIGATION OF EFFECTS

Investigation of any possible deleterious effects involved the consideration of (a) a complete physical examination of the personnel who were to be or had been exposed to these fields in order to determine their norm for comparison with findings under (b) and (c); (b) observation (clinical and laboratory) of volunteers during exposure; (c) post exposure examination; (d) observation, including post-mortem findings, of animals exposed to these electrical fields.

(a) *Preliminary examination of human subjects (volunteers).*—This embraced a medical history, an electrical exposure history, and a complete physical examination, including blood count and urinalysis. The findings were noted as establishing the base line for each individual and for later reference. No abnormal findings which could be ascribed to the effects of super-high-frequency currents were revealed.

An inquiry into the illnesses of three men employed in the high-frequency work revealed the following histories:

1. R. C. S., had an arrested case of pulmonary tuberculosis when he entered the employ of the Research Laboratory. The tuberculosis subsequently became active and he is now undergoing domiciliary treatment.

2. J. D. W., a resident of Louisiana, had a malarial condition for two years before entering the employ of the Naval Research Laboratory. The malaria was resistant to ambulant treatment and he is now undergoing hospital treatment for the malarial infestation.

3. J. T. F., an assistant radio engineer, was pursuing advanced academic work at a local university in addition to his regular duties at the Naval Research Laboratory. His friends report that he was

overworking, obtaining insufficient sleep, and no outdoor exercise. He developed active tuberculosis.

None of these illnesses can possibly be ascribed to electrical effects and none of these three men were used in these tests.

The six volunteers were radio engineers and physicists attached to the research laboratory. Four had had exposure to superhigh frequency for the past year. Two had practically no previous superhigh-frequency exposure and served as controls.

All those who had been definitely exposed and had experienced symptoms were unanimous in stating that repeated daily exposures cause headache, weakness, and drowsiness, and that the weakness and the lethargy occur earlier in succeeding exposures, become more intense, and last longer after the exposure ceases. All reported also that they were always entirely normal following a day or two without exposure to the superhigh-frequency fields. The complaints are limited to those working with currents of 10 to 20 kilowatt power. There has been no subjective distress among the personnel working with $\frac{1}{2}$ to 2 kilowatts and frequencies up to 75,000,000 cycles.

The maximum exposure occurred in an assistant radio engineer (D), who estimates that he has had an average daily exposure of 20 minutes for the past year to a current of 5 to 20 kilowatts at frequencies of 4,000,000 to 55,000,000 cycles per second.

(b) and (c) *Observation of volunteers exposed to the superhigh-frequency fields.*—This observation embraced—

- (1) Wet and dry bulb thermometer and barometer readings.
- (2) Air flow.
- (3) Body temperature, pulse rate, blood pressure, and respiratory rate during and at intervals after exposure.
- (4) Urinalysis, complete blood count, blood-urea nitrogen, creatine, CO₂ combining power, blood sugar, blood chlorides, blood phosphorus, blood calcium, and coagulation times, taken immediately after exposure for comparison with the before-exposure record.
- (5) Skin temperatures.
- (6) Symptoms and time of appearance.

1. Atmospheric conditions varied from dry bulb and wet bulb maximum readings of 27 and 19° to minimum readings of 21.5 and 15° C., respectively. The exposed personnel were relatively more comfortable on cooler, less humid days, but except for delayed development the symptoms did not appear to be modified.

Barometric readings varied from 29.60 to 30.08.

The relative comfort of exposed personnel on cooler days must be ascribed to the atmospheric conditions favoring heat lost by the body, since the change of electrical constants of the atmosphere would be entirely negligible in altering the degree of electrical exposure.

2. Slight draughts were always present, though the rate of air flow was insufficient to be recorded by an anemometer.

3. The mouth temperature of the person exposed regularly rose several tenths of a degree, the maximum elevation being from 98.8 to 100.

There was a tendency for the pulse rate to become accelerated during exposure. The maximum change was a pulse rate of 80 becoming 114.

The blood-pressure changes were so slight that they were well within the limits of normal variation. There was, however, a distinct tendency for both systolic and diastolic levels to be slightly lower one-half hour after the exposure.

The respiratory rate was unaffected.

4. The results of the laboratory examinations are combined in Table I. The only consistent finding is a slight drop in the CO_2 , combining power of the blood plasma, and a slight though fairly regular deviation of the urinary pH to the acid side.

5. *Surface temperatures.*—A rather remarkable change in the skin temperature was recorded by the very crude method of placing spirit thermometers on the wrists of the two hands. The hand holding the antenna gave readings from 2° to 5° C. higher than the other hand. This skin temperature elevation occurred before any rise in the mouth temperature.

6. *The occurrence of subjective symptoms.*—These progress in a fairly regular order. They are presented, together with other observations not included in the table "Summary of laboratory data," in Table No. 2, which is in three sections.

The first symptom of warmth in the antenna hand occurred immediately. After three to five minutes the discomfort became so intense that it would be necessary to shift the antenna to the other hand. The sensation of warmth would be next felt in the feet and ankles, then the body generally, then about the head.

The second symptom usually was a cramplike pain felt in the bones or tendons of the wrist of the antenna hand. This usually appeared in about three minutes. It rapidly attained excruciating proportions. It disappeared immediately on releasing the antenna. Local muscular weakness accompanied the pain. The pain could not be localized. It was not a joint pain. There was no evidence of tetany or spasm of the muscles of the forearm. In some the pain seemed superficial, being increased by pressure. In others, all degrees of external pressure had no effect on the pain. A pain of the same character would sometimes be felt in the ankles.

The third symptom was sweating. It followed the same course as the sensation of warmth. In only one of the six exposed was the sweating described as exhaustive.

The fourth symptom was either weakness, drowsiness, or headache. Nothing characteristic was elicited about these symptoms. The weakness was general; it was that of fatigue rather than exhaustion. The drowsiness was of the normal type. The headache varied in location, in character, in intensity, in duration, and it was unassociated with blood pressure, pulse rate, or degree of temperature elevation.

In the three volunteers who had repeated exposures a loss of weight occurred. One (O. C. D.) having five exposures lost $2\frac{1}{2}$ pounds during the week of exposure. This was regained in two weeks. His headache had become constant during the last two days of the exposure and this headache persisted for three days following exposure. He reported a noticeable lack of energy and endurance. The recovery from this was gradual but progressive during three weeks. An intercurrent respiratory infection may have been a factor in his prolonged symptomatology.

Another (R. A. G.) having three exposures had lost 2 pounds the week before exposure and lost 6 pounds during the week of exposure. This weight loss, remaining stationary for the few days at the end of the exposure week, was regained during the following two weeks. A noticeable lack of energy and endurance occurred which gradually disappeared in three weeks.

In connection with the loss of weight and other symptoms in this case, it is to be noted, as very probably contributory, that this man had been making a difficult radio installation in a submarine before exposures, and that he continued this work during and after the period of the test.

The third volunteer (L. C. Y.) lost 5 pounds during the week of exposure and regained it in two weeks. He had no subjective symptoms following the exposures.

It seemed that the taller men among the volunteers, and those of a blond complexion suffered more electrical effects than shorter, darker men.

L. C. Y. was the shortest man in the group and is a pronounced brunette.

O. C. D., who developed the greatest effects, is a 6-footer with light brown hair.

R. A. G., whose symptomatology was intermediate, is a 6-footer but a pronounced brunette.

(d) *Animal experiments*.—For purposes of observation the animals were divided into three groups:

1. On the 22d, 23d, and 25th of August, at the Naval Research Laboratory (18 kw., 55 m. cycles, 5.45 meters, 15-inch air gap and 45-minute exposure), and subsequently at the Carnegie Institution ($3\frac{1}{2}$ kw., 61 m. cycles, 4.92 meters, $5\frac{3}{4}$ -inch air gap, and 30-minute

exposure), beginning August 28,¹ for an additional period of six successive days, six guinea pigs were subjected to a sufficient exposure to induce temperatures of 106° to 109° F. The hyperthermia induced varied in the different pigs. After exposure on September 1 (seventh day) all appeared in normal condition except the white (temperature 108.2° F.) and brown (temperature 106.4° F.) pigs, which were, respectively, "just able to crawl" and "quite weak." After exposure on September 3 (ninth day) the white pig, whose temperature had reached 110° F., died (a thermic death) and was autopsied.² Thereafter reduced exposure time was used for 28 additional exposures, making a total of 35 exposures. The standard exposure adopted was 15 minutes, with other conditions as above. The condenser plates were covered with plate glass to prevent arc burns. With a power of 3½ kilowatts to oscillator and a frequency of 61 m. cycles and with the pigs in position, an electroscope indicated approximately 300 volts R. M. S. (root mean square) radio frequency. Since unrectified alternating current was used on the plate of the oscillator, the radio-frequency peak voltage would be considerably higher than this figure, but certainly could not exceed, for example, 2,500 volts. The brown pig died September 29 and was autopsied.³ The remaining pigs were given sufficient exposures six days per week to cause a temperature of 104° F. The average weight of the six pigs was 698 grams. The weight of the white pig was 664 grams and of the brown 686 grams. Two of the surviving pigs were killed and autopsied; the other two are still alive and apparently normal (January 21, 1931).

2. The second group of six pigs, average 406.33 grams in weight, was subjected to the test on six days of each succeeding week for a total of 27 exposures. All of these exposures were sufficient to induce a temperature of 104° to 106° F., the time factor (8 minutes) being the only variant in the conditions obtaining as compared with those to which the first group was exposed at the Carnegie Institution. Four of this group survived the exposures, two having died of intercurrent disease (pneumonia) and two of the survivors were killed and autopsied. The remaining two are still alive and apparently normal (January 21, 1931).

3. The third group of animals consisted of four cats, each of which was subjected, under conditions parallel to those obtaining with the animals of the other groups. The exception, as required by the larger size of the cats, was that the air gap was increased to 7 inches. Owing to this fact the radio-frequency voltage between the plates

¹ On August 26 the machine at the Naval Research Laboratory broke down and the pigs were transferred to the Carnegie Institution.

² Intercurrent infection (inflammatory pleurisy).

³ Pneumonia.

was undoubtedly somewhat different. There was a sufficient exposure to cause temperatures of 102° to 104° F. Exposures began September 22 and 6-day-per-week seances were continued. Two of them died of intercurrent disease (pneumonia). The two that survived were given a total of 12 exposures. One of these was killed and autopsied; the other one is still alive and apparently normal (January 21, 1931).

The animals were exposed in a dry wooden box with air holes. They were frequently weighed and examined daily for ill effects. Two of the surviving pigs in the first group were rendered comatose and had convulsive seizures. None of the animals lost weight. Except for the electrical exposures and confinement, the living conditions of the experimental animals were normal in every way. The intercurrent disease, causing death in some of the animals, is believed due to the chilling contrast of the existing atmospheric conditions immediately after the induced internal temperature.

A fourth and supplementary group of some 20 reserve pigs was subject at irregular intervals to short and intense exposures. About 50 per cent of these showed local superficial transient disturbances with resulting alopecia and eschar. The snout of one pig was thus affected and, curiously and inexplicably, the outer left carpal area of the other affected pigs of this group.

No direct evidence was obtained as to the relative resistance or susceptibility of the experimental animals nor was any variation in basic resistance noted under conditions of exposure in the tests. It may be noted that the pig which died a thermic death was an albino, but this fact can not be taken too seriously, for its resistance had been lowered by some intercurrent infection and the temperature which it developed would probably have killed any of the other pigs. Under the circumstances, the question of the protection offered by pigment in the lower tolerable temperatures induced in the other animals under parallel exposures is purely academic. All the living animals will be kept under observation to determine if any late effects occur. If so, they will be autopsied and the organs and lesions studied as the basis for a further report.

Prof. Arthur Knudsen, of Albany Medical College, advises us that, in experiments subsequent to a preliminary report to the International Physiological Congress (3), he and Philip J. Schaible induced a temperature of 106° F. in rats every day for a period of two to four months without any cumulative effect. And Dr. R. V. Christie, writing to us personally, says, "Of course, if the heat production leads to systemic elevation of temperature, changes in the blood pressure, blood chemistry, etc., can be observed, but there is absolutely no evidence to show that any of these changes have a dele-

terious effect " short of the direct lethal results of extreme hyperpyrexia.

In personal communications, Dr. W. R. Whitney, of the General Electric Co., who has had prolonged opportunity to observe the effects of superhigh-frequency radio, advises that nothing harmful has resulted from radio fever below 105° F., and that although "probably dangerous to run much higher temperature" experiments with animals (dogs, rabbits, mice, etc.) indicate the lethal temperature to be above 108° F. He says the first dog received by him for experimental exposure over a year ago was a sickly animal, but is alive and well now after 10 or more exposures for 40-minute periods developing a temperature as high as 105.5° F.; that Doctor Knudsen, of Albany Medical College, thinks a dog may be heated as high as 110° F. for a moment, though prolonged heating at that temperature is fatal; and that Doctor Walker, of Baltimore, has found mice to stand a temperature as high as 112° F.

In the exposure of animals at the Naval Research Laboratory, two metal plates were substituted for the radio aerial, and the experimental animals were placed in an insulated perforated wooden box between the plates. A current of 15 to 18 kilowatts, with a frequency of 55,000,000 cycles per second, was used. The air gap between the plates was 12 inches.

At the Carnegie Institution Laboratory, to which the animal work had to be transferred, a machine of the same capacity was used, but the power was reduced to 3½ kilowatts in order to give the desired rate of temperature rise with an air gap of 5¾ inches. The frequency was 61,000,000 cycles per second. Here also the animals' exposure to the field was in an insulated perforated wooden box.

POST-MORTEM EXAMINATION OF ANIMALS

The gross and histological post-mortem examination of the tissues of these animals showed only thermic changes. All the organs and tissues that could be of any possible interest from the point of view of this study were sectioned. The pathological report is as follows:

Examination of slides from guinea pigs and cats exposed in the field of high-frequency current show mild degeneration and circulatory disturbances.

The central nervous system shows some congestion with small capillary hemorrhages and mild edema. The ganglion cells show varying degrees of haziness and indistinctness of cellular structure.

Sections from parenchymatous organs also show varying degrees of acute congestion and cloudy swelling.

Sections from denuded areas on the forelegs show coagulation necrosis of the epithellum with congestion, hemorrhage, and pus cell infiltration in the subcutaneous tissue resembling a burn.

The thermic influence, with which we are concerned, carried to its ultimate pathologic expression by repeated severe exposures would adequately account for the gross pathology observed either as a direct tissue necrosis or an indirect death of the part from trophic disturbance—changes in trophic centers or nerves, as conjectured by Tuve and Whitman.

DISCUSSION

The figures relative to the degree of exposure of our human subjects can be only approximate, as the path of greatest current intensity was undoubtedly shifting and there was no way of accurately measuring or estimating the intensity of the electrical field to which they were exposed. It is quite certain, however, that except for the imposed condition of relative physical rest the factors in the tests determining physiologic reaction were made much more severe than is normal to ordinary working conditions. This was insured by the arrangements and evidenced by the history of symptomatic reactions. It was not possible, of course, to carry the human tests beyond this stage.

The majority of the symptoms complained of were merely heat effects as ordinarily experienced. With the possible exception of the prolongation of drowsiness and weakness, all of the symptoms have been observed in the study of certain miners.

In still air in metal mines, with a wet-bulb temperature of over 90° F. and under 100° F., and with a relative humidity of 80 per cent or higher, the following symptoms were found, even when little or no exercise was taken:

1. Blood pressure, systolic and diastolic, fell rapidly.
2. Body temperature rose; in one case it reached 102° F., and this after less than two hours having been spent in the hot, humid air described.
3. Pulse rate increased and seemed more sensitive to exercise than normally.
4. Perspiration was very profuse.
5. Dizziness was a common symptom and sometimes was marked.
6. Physical weakness or exhaustion was marked in some cases and present in all.
7. Inability to think quickly or accurately was a very common symptom.
8. Nausea was occasionally found.
9. Headache was also occasionally found.
10. Loss of weight was especially marked in men who had been employed under above conditions over a period of years, but occurred even after exposure only a few hours (10).

In our own observations three of the volunteers and the medical officer and medical technician, who are familiar with heat effects as encountered in the firerooms of ships, were in agreement that the late headaches, the prolonged drowsiness and general feeling of weakness or physical inertia are not experienced in exposures to mere thermic environment. Some different influence is expressing itself in the modified symptomatology and it is believed that the

peculiar or specific factor is the difference between the surface application of heat, in the imposition of an additional load upon the heat-regulating mechanism, and its development within the body and the process of its production.

Whatever part of the field is occupied by the body, that part of it becomes a system composed of two condensers in series with a resistance. It is probable that the action is largely that of a dielectric, "in which electrons in the molecules of the body cells will, according to their state of freedom, either pass from molecule to molecule, first in one and then the other direction, or, if bound, are stressed in a direction the polarity of which alternates at the oscillator frequency" (4). The size of tissue cells would play a definite rôle in this as determining response to frequency, and the power behind a given frequency would determine the particular effect on cells of the responsive size. Although possible that, all conditions being favorable, a cell might be ruptured by violent vibration no such effect has been reported, as far as we know. "It is known that the physiological effect of alternating currents can be profoundly changed by changes in frequency" and that "accompanying the change in the physiological response with increased frequency, there is a change in the path of the current through the tissues" (5).

As regards the symptoms other than pyrexia which seemed different from those experienced incident to exposure to surface heat, they are believed explainable as the consequences of this harmonic response "in the form of electromechanical vibrations of the living cell caused by the rapid alternation in polarity of the field" (4). They constitute the effects of a nerve and other tissue cell exhaustion influence of a purely physical nature decreasing the power of their return to functional normalcy depending upon severity of and interval between repeated exposures. In this connection, it is interesting and corroborative to note that repeated severe exposures at short intervals caused symptoms to occur earlier, to be more pronounced, and to last longer. Following the extreme daily exposure to which the volunteers were subjected, two of them reported that it took a month for the symptoms to wear off. Schereschewsky observed a similar delayed return to normal in the case of an assistant.

No previous observations or pointed tests concerning a possible health hazard affecting radio workers occupied with ultra high-frequency transmitters have been reported. Aid in the determination of the question is limited to the results of investigation with animal subjects and material of that sort is abundant and interpretable in terms of definite value to tenable conclusions in the present inquiry.

The results with our own animals have been set down in previous pages. The findings and expressed opinions of the several scientists who have been consulted are to the purport, with one exception,⁴ that these currents are without ill effects apart from those accounted for on the basis of heat production and accumulation. Indeed, Christie and Loomis (5) maintain that the burden of proof still lies on those who claim otherwise. In this connection, by means of the incubator and water bath, they made an exact determination of what temperature per se could be tolerated by the normal mouse and found a close "agreement between that leading to death in these experiments and that resulting from the radiations." Other experiments with mice and frogs were performed to show that these currents are harmless apart from this heating effect.

In the work of Schereschewsky with transplantable tumors in mice, microscopic sections of the tumors removed after radiation gave a picture resembling coagulation necrosis.

The hairy animals, by virtue of their coat, suffer a definite handicap in heat regulation and the prompt lethal effects of induced extreme hyperpyrexia as well as the histopathological developments of thermic origin and character may be accounted for by that fact. The primary fatal effect is the expression of a body temperature out of proportion with the capacity of the heat regulating mechanism in safeguarding life; the histopathology is the expression of the effects of heat on protoplasm; and the symptoms the expression of physical trauma with reduced functional efficiency. A state of activity or quiescence in the subject and the atmospheric conditions (temperature, pressure, relative humidity, and air movement) are not unimportant factors under the circumstance of exposure to the heat-producing influence of high-frequency radiations.

In the human subject also under similar extreme exposure and conditions conducive to heat accumulation there is the possibility of disturbance of the heat-regulating mechanism, centrally or in one of its components, with resulting uncontrollable body temperature movements after removal from exposure. This is a common observation in heat stroke and has been the observation in at least one case in which the therapeutic employment of high-frequency radiation overreached tolerable limits. But whatever the degree of exposure, heat production by rapidly alternating induced electric currents within a highly specialized living organic resistance is attended by a temporary greater or less impairment of function, due to a tiring of the cellular element of the tissues by electromechanical vibration, which in the human subject becomes available, in building a picture of the complex reaction, as subjective symptoms.

⁴ Mellon et al. (8).

There seems some variation in the subjective evidence of reaction, though not necessarily in susceptibility, according to the nervous or phlegmatic inclination of the temperament of exposed persons. This was noted by Schereschewsky as between himself and an assistant and by ourselves in the volunteer human subjects among whom there appeared a difference in development, severity, and persistence of symptoms. The nervously sensitive type gave a more pronounced picture, aside from any proneness of a given individual to exaggerate. This was also the case in our human subjects, other things being equal, with those of taller stature and fairer complexion.

The foregoing data and discussion has to do with the effects and results of extreme exposure to superhigh-frequency radio currents as they bear upon the conclusions we are called upon to express. The electrical exposure of our human subjects was raised to an intensity, though unmeasured, much in excess of that normal to regular working conditions, while, as far as controllable, in other factors having conjectural influence in augmenting or modifying the electrical effects, the normal was sought. The electrical exposure of our animals was controlled and calculated, as far as is possible in using the field between condenser plates, and was raised to a degree of intensity consistent with tolerance, differing in each group for purposes of comparative study. The symptomatic and structural effects of sublethal doses have been described.

Relative to the particular point of frequency per se which is naturally injected into the question by the qualifying term "high" in the subject title, Schereschewsky is of opinion that frequency has an important bearing upon lethality while Christie and Loomis believe "that the lethal nature of these radiations is proportionate to the intensity of the field up to a frequency of about 50,000,000 cycles" (5). However, maximum reaction, whether explained on the basis of frequency or intensity, does seem to be identified with a frequency in the neighborhood of 50,000,000 cycles (wave length, 6 meters), which is approximately the natural period for quarter-wave oscillation of an antenna the length of the human body. This is about the frequency with varying power at which some of our tests were conducted. There seems to be agreement that in higher frequencies there is diminution in reaction and in this connection it is recalled that, in the history of previous exposures of personnel at the Naval Research Laboratory, no subjective distress was experienced by those working with one-half to 2 kilowatts and frequencies up to 75,000,000 cycles. Complaints came from those working with higher power (10 to 20 kilowatts) which seems to suggest the predominating importance of intensity, although in studying a subject included within the broad band of radiant energy we can not evade the idea that frequency plays a specific part in the observed effects. To play such a part it need not do other than produce the

electromechanical vibration above considered, but even in this the influence of intensity can not be ignored.

Our inquiry has brought to light no case, either in laboratory experimentation or radio work anywhere, of injury to a human being by the temperature effects of high frequency or otherwise. E. F. W. Alexanderson, of the General Electric Co., points out that "in order to induce fever of any consequence it is necessary to use quite a special arrangement" to insure definitely the exposure of the subject to the effects of a high-frequency alternating current. The observations of Whitney in this respect have already been mentioned.

In most work with radio transmitters, as at the Naval Research Laboratory, on board ship and elsewhere, one antenna is used and not a condenser field in the ordinary sense. The experiments with our volunteers at the Naval Research Laboratory were, proper to the determination we were asked to make, under arrangements and conditions representing a mere exaltation of those normal to routine work. The intensity and frequency of the current were such as to produce maximum effect and yet the reaction in terms of fever was generally less than 1° F.

The severest exposure under conditions which ordinarily obtain at the Naval Research Laboratory incident to work in the immediate vicinity of high-powered short-wave oscillators may be expected to produce only moderate transient subjective symptoms of the character described, slight lowering of blood pressure, and slight increase of body temperature.

CONCLUSIONS

Answering the specific question, viz, "What dangers to human health, if any, are likely to result from the use of superhigh frequency for radio communication?" our opinion is that from a practical point of view there are none.

In expressing this opinion we are limiting ourselves to the subject as involved in the present and probable future normal exposure of Navy personnel and employees either in the development and testing of high-powered transmitting apparatus at the Naval Research Laboratory or elsewhere and their operation in the service ashore or on board ship wherever installed. That is clearly the Navy's primary interest in the matter and the background of the inquiry.

Both directly and by inference we have discussed the degree of exposure in connection with the development and testing of apparatus fabricated at the Naval Research Laboratory. Exposures to induced fields of radiant energy, incident to tuning up and operating installed apparatus, are even less severe in respect to time and intensity. In either case the field is variable and not concentrated and the transmitter sets installed on board ship are somewhat less power-

ful than that at the Naval Research Laboratory. Moreover, the transmitters in regular service are inclosed in metal cabinets and consequently electrically shielded; whereas the transmitters in the laboratory are held in open experimental construction and consequently not shielded. In other words, radiation from various parts are suppressed in the one but not in the other, so that exposure to uncomfortable symptoms is much less likely, if at all likely, with service machines.

As regards the transient discomfort, and hence reduced efficiency of the laboratory force concerned, it may be minimized by attention to certain factors observed in the course of our investigation.

(a) The removal from the possible induction field of anything which might operate as a second antenna or electrode and thus to intensify and concentrate the field.

(b) The reduction of testing time to the actually essential and not "idling" the apparatus with personnel near by.

(c) The erection of such electrical screens as will not interfere with the work, yet provide the maximum shielding.

(d) As far as may be possible, the employment of men on the work with reasonable regard for the temperamental and physical qualifications which seem to reduce susceptibility.

(e) As far as may be possible, the selection of days for testing which are characterized by atmospheric conditions favorable to body-heat regulation or secure air movement to that end by artificial means.

(f) As far as may be consistent with requirements, the avoidance of the 50,000,000-cycle frequency (6 meters) which has been suggested as the critical period.

(g) Provision for the distant control of transmitters.

For purposes of future study it would be useful if the laboratory would keep individual running records of reaction in relation to frequency and intensity of current and time (period) of exposure in the field of the oscillator.

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BIBLIOGRAPHY

1. Schereschewsky, J. W.: The Action of Currents of Very High Frequency Upon Tissue Cells. *Public Health Reports*, 43: 927, April 20, 1928.
2. Carpenter, C. M., and Boak, R. A.: The Effect of Heat Produced by an Ultra High Frequency Oscillator on Experimental Syphilis in Rabbits. *Am. Journal Syphilis*, 14: 346, July, 1930.
3. Schaible, J. P., and Knudsen, A.: Chemical Changes in the Body Resulting from Exposure to Ultra-High Frequency Field, Reported at XIII International Physiological Congress, 1929.
4. Schereschewsky, J. W.: The Physiological Effects of Currents of Very High Frequency. *Public Health Reports*, 41: 1939, September 10, 1926.
5. Christie, R. V., and Loomis, A. L.: The Relation of Frequency to Physiological Effects of Ultra-High Frequency Currents. *Journal Exp. Med.* 49: 303, February, 1929, and personal communication.
6. Carpenter, C. M., and Page, A. B.: The Production of Fever in Man by Short Radio Wave. *Science*, 71: 450, May 2, 1930.
7. Tuve, M. A., and Whitman, W. G.: Unpublished Super-High Frequency Data, 1930.
8. Mellon, R. R., Szymanowski, W. T., Hicks, R. A.: An Effect of Short Electric Waves on Diphtheria Toxin Independent of the Heat Factor. *Science*, 72: 174, August 15, 1930.
9. Smith, E. E.: Heat Stroke a Thermoregulatory Incompetency. *U. S. Nav. Med. Bull.*, 26: 479, July, 1928.
10. Sayers, R. R., and Harrington, D.: A Preliminary Study of the Physiological Effects of High Temperatures and High Humidities in Metal Mines. *Public Health Reports*, 36: 116, January 28, 1921.

TABLE I.—Summary of laboratory data—The difference between findings (changes occurring) in the examinations before and after exposure

[+ Increased; — Decreased; X unchanged]

Case	Y	Y	Y	Y	DR	DR	DR	DR	G	G	M	W	DA	Total + and —
Red blood count..... number.....	-40,000	-200,000	-80,000	-140,000	-140,000	-140,000	+10,000	+40,000	+70,000	+20,000	-130,000	-60,000	+100,000	+5
White blood count..... do.....	+500	+1,900	-900	+2,500	+2,500	+2,500	-500	-300	+200	+1,500	-1,400	-600	-1,200	-8
Polys..... per cent.....	+13	+3	X	+6	+6	+6	+3	-9	+4	-4	-3	+5	+3	+7
Band forms..... do.....	+4	X	X									+1	X	+8
Segmented..... do.....	+9	+2	X	+6	+6	+6	+3	-9	+4	-3	-4	+4	+3	+4
Lymphocytes..... do.....	-6	-3	-1	-8	-8	-8	-7	+11	-2	+3	+4	-5	X	+4
Eosinophiles..... do.....	-3	X	X	+3	+3	+3	X	-1	-1	+2	+1	-1	-1	+3
Basophiles..... do.....	0	0	0	-1	-1	-1	-1		X					+0
Monocytes..... do.....	-4	X	X	X	X	X	+4	-1	-1	-1	-2	+1	-2	+3
Hemoglobin..... do.....	X	X	X	-5	-5	-5	+5	X	X	X	X	X	+5	+6
Coagulation time, minutes: sec- onds.....	X	-0.5	X	+0.4	+0.45	+0.45	+0.10	+0.55	+1.15	-0.10	-0.50	X	+0.30	+2
Blood urea nit. milligrams per 100 cubic centimeters.....	X			+1.0	X				X	-3.0	X	X	-2.0	+7
Creatinin. milligrams per 100 cubic centimeters.....	X			-1	+2				-2	X	+1	X	+1	+1
Blood milligrams per 100 cubic centimeters: Sugar.....	+9			X	-21				X	X	+6	-10	+4	+3
Calcium.....	+0.3			X	+1.3				X	-2	+1	+0.2	-1	+4
Phosphorous.....				X					X	+2	+1	+0.1	-7	-3
Chlorides.....	X			X	+38				X	-20	X	X	-40	+1
Blood indican qualitative.....				X					X		X	X	X	+0
CO ₂ combining power volume.....	-3.7			-2.2	-8.5				-4.2	-2.2	-2.4	X	-1.2	+1
Urine: Specific gravity.....	-1.005	X					+0.001		-0.004	+0.006			+0.002	+2

[illegible]

TABLE II.—Section 1.—Observations on exposure of volunteers to super-high-frequency currents

	W-1	M-1	DA-1	G-1	G-2
Date and hour	Aug. 19, 1930.....1. 20 1. 54	Aug. 20, 1930.....10. 25 11. 00	Aug. 19, 1930.....10. 20 11. 00	Aug. 20, 1930.....1. 19 1. 54	Aug. 22, 1930.....10. 36 11. 08
Temperature, dry bulb: Before exposure	27 C.....	25 C.....	24.5 C.....	26.5 C.....	21.5 C.....
After exposure	27.5 C.....	26.5 C.....	25.5 C.....	27.5 C.....	21 C.....
Temperature, wet bulb: Before exposure	19 C.....	19 C.....	17 C.....	18.5 C.....	15.5 C.....
After exposure	17.5 C.....	19.5 C.....	18.5 C.....	18 C.....	15 C.....
Relative humidity: Before exposure	44.....	53.....	46.....	44.....	50.....
After exposure	37.....	47.....	50.....	39.....	50.....
Air flow.....	Slight draughts.....	Slight draughts.....	Slight draughts.....	Slight draughts.....	Slight draughts.....
Barometer: Before exposure	29.96.....	30.04.....	29.85.....	30.04.....	30.08.....
After exposure	29.94.....	30.06.....	29.86.....	30.05.....	30.06.....
Current: Kilowatts.....	18.....	18.....	18.....	18.....	17.....
Cycles.....	55,000,000.....	55,000,000.....	55,000,000.....	55,000,000.....	55,000,000.....
Exposure, minutes.....	34.....	35.....	40.....	35.....	32.....
First symptom: Minutes.....	Warmth immediately.....	Warmth immediately.....	Warmth immediately.....	Warmth immediately.....	Warmth immediately.....
Progress.....	Increase.....	Increase.....	Increase.....	Increase.....	Increase.....
Disappearance, current off.....	Immediate.....	Immediate.....	Immediate.....	Immediate.....	Immediate.....
Before exposure: Temperature, pulse, and respiration.....	98.2 78 14.....	98.6 80 21.....	98.4 78 14.....	99.2 96 12.....	98.6 84 12.....
Blood pressure.....	108/70.....	108/58.....	116/78.....	124/78.....	110/76.....
Second symptom: Minutes.....	Sweat, 5.....	Pain, antenna wrist, 3.....	Bone pain, antenna hand, 5.....	Pain, 3.....	Pain, 3.....
Progress.....	General, from antenna hand.....	Increase.....	Increase.....	Increase.....	Increase.....
Disappearance, current off.....	Gradually.....	Immediate.....	Immediate.....	Immediate.....	Immediate.....
During exposure, temperature, pulse, and respiration.....	99 100 20.....	Temperature 99 and 99.4; pulse, 108 and 114.....	99.4 96 16.....	Temperature 99.6 in 5 minutes; 99.8 in 20 minutes.....	Temperature, 99.8 at 11.....
Third symptom: Minutes.....	Pain, antenna wrist, 10.....	Sweating, 5.....	Sweating, 12.....	Sweating, 5.....	Sweating, 16.....
Progress.....	Increase.....	Increase.....	Increase.....	Increase.....	Increase.....
Disappearance, current off.....	Immediate.....	Gradually.....	Gradually.....	Gradually.....	Immediate.....
Immediately after exposure Temperature, pulse, and respiration.....	99.8 90 11.....	99.2 90 16.....	99 84 17.....	100.4 110 14.....	99.5 84 14.....
Blood pressure.....	110/60.....	118/70.....	110/70.....	118/62.....	110/82.....

Fourth symptom:	Suboccipital headache, 20	Drowsiness at 11.05	Drowsiness at 11.05	Weakness, 25	Headache at 11.10
Minutes.....	Stationary	Steady	Steady	Steady	Increase
Progress.....	4 hours	3 hours	6 hours	18 minutes	2 hours
Disappearance, current of.....	98.2 72 21	98.4 82 14	98.4 60 18	99.8 96 13	99.5 72 12
One-half hour after exposure:					
Temperature, pulse, and respiration.....					
Blood pressure.....	102/60	102/58	108/70	112/74	100/70

NOTES

Column W-1.—Skin temperature, antenna hand, 40° C.; other hand, 38° C.
 Column M-1.—Skin temperature, antenna wrist, 38° C.; other wrist, 32° C.; while mouth temperature is normal. At 15 minutes, mouth temperature, 99° F.; pulse, 108; at 27 minutes, temperature, 99.4; pulse 114.
 Column D-A-1.—Skin temperature, antenna hand, 34-35-40-C.; other hand, 29-31-36.5-C. After 4.30 felt only a normal type of fatigue, but more fatigue than usually experienced.
 Column G-1.—At 3 p. m. no symptoms other than drowsiness, which disappeared at 4.30. At 3.30 developed frontal headache, duration 3 hours.
 Column G-2.—At 12.06 p. m. headache, general weakness, and drowsiness. At 1 p. m. all symptoms present, but scarcely noticeable.

TABLE II.—Section 2.—Observations on exposure of volunteer (Dr.) to super-high-frequency currents

	DR-1	DR-2	DR-3	DR-4	DR-5	DR-6
Date and hour.....	Aug. 18, 1930, 1.10 to 2.35.	Aug. 19, 1930, 11.30 to 12.	Aug. 20, 1930, 11.26 to 12.20.	Aug. 21, 1930, 10.22 to 10.45.	Aug. 21, 1930, 1.27 to 1.40.	Aug. 22, 1930, 10.35 to 11.05.
Temperature, dry bulb:						
Before exposure.....	26.7 C.....	26 C.....	26.5 C.....	24 C.....	26 C.....	21.5 C.....
After exposure.....	28.9 C.....	26 C.....	27 C.....	25 C.....	26.5 C.....	21 C.....
Temperature, wet bulb:						
Before exposure.....	22.8 C.....	18 C.....	19.5 C.....	18 C.....	18.5 C.....	15.5 C.....
After exposure.....	20.6 C.....	19 C.....	20 C.....	18.5 C.....	18.5 C.....	15 C.....
Relative humidity:						
Before exposure.....	67.....	44.....	50.....	55.....	47.....	53.....
After exposure.....	43.....	50.....	50.....	53.....	44.....	53.....
Barometer:						
Before exposure.....	29.86 29.92.....	29.86 29.98.....	30.05 29.84.....	30.08 29.76.....	30.08 29.76.....	30.08 30.04.....
After exposure.....	28.6 29.....	29.85 29.98.....	30.05 29.84.....	30.08 29.76.....	30.00 29.76.....	30.08 30.04.....
Current:						
Kilowatts.....	16.....	18.....	18.....	18.....	18.5.....	17.....
Cycles.....	55,000,000.....	55,000,000.....	55,000,000.....	55,000,000.....	55,000,000.....	55,000,000.....
Exposure, minutes.....	35.....	30.....	34.....	On 13, off 4, on 6, Total 19.	22.....	30.....
First symptom:						
Minutes.....	45 seconds.....	Immediately with joint pain.	Warmth immediately.	Immediately.	Immediately.	Immediately.
Progress:						
Disappearance, current off.....	Progressive.	Progressive.	Increase.	Increase.	Increase.	Increase.
Before exposure:	Immediate.	Immediate.	Immediate.	Immediate.	Immediate.	Immediate.
Temperature, pulse, and respiration.....	99.2 80 20.....	98.2 83 18.....	.....	98.6 76 16.....	98.4 84 14.....	98.2 72 15.....
Blood pressure.....	118/60.....	94/62.....	.....	108/58.....	108/56.....	104/60.....
Second symptom:						
Minutes.....	1.....	10.....	10.....	5.....	6.....	16.....
Progress:						
Disappearance, current off.....	Progressive.	Progressive.	Increase.	Increase.	Increase.	Increase.
Immediately after exposure:	Immediate.	Immediately but gradually.	Immediately.	Immediately.	Immediately.	Immediately.
Temperature, pulse, and respiration.....	99.4 80 22.....	99.1 78 20.....	99.6 84 16.....	.....	99.2 84 16.....	99 76 16.....
Blood pressure.....	120/70.....	108/70.....	104/70.....	.....	124/90.....	102/58.....
Third symptom:						
Minutes.....	5.....	10.....	30.....	10.50.....	Augmented for 2 minutes.	Augmented immediately.
Progress:						
Disappearance, current off.....	Steady.	Steady.	Steady.	Steady.	Steady.	Steady.
Continued until asleep, 9 p. m.	Continued until asleep, 9 p. m.	At 4.30 p. m.	7.30 p. m.	12.30 p. m.	6.30 p. m.	Slowly to steady ache.

1 hour after exposure: Temperature, pulse, and respiration.	98.4 75 21	98.0 78	98.4 72 16	98.6 78 16	(1/2 hour after.) 98.6 76 18.
Blood pressure	110/80	96/60	104/86	100/60	110/76.
Fourth symptom:	5	10—legs only	10	5	5
Minutes	Worse	Steady	Steady	Began in legs then thru body.	Steady.
Progress	Continued until fell asleep.	Persists	Improved after 7 p. m.	Continued	
Disappearance, current off					
Temperature, pulse, and res- piration.					Mouth temperature 99 at 11.05.

NOTES.—Body weight before and after exposure, no change. Aug. 18, 1930, weight 149; Aug. 22, 1930, weight 147½; Aug. 25, 1930, weight 146.

First symptoms: Heating of left (antenna) hand followed by both feet, head, and body in order named.

Second symptoms: Sweating; skin temperature.

Third symptoms: Headache, frontal and bitemporal—not throbbing.

Fourth symptoms: Weakness general.

Column DR-1.—Skin temperature antenna, hand 37° C.; other hand, 34° C. Discomfort—weakness, drowsiness, and headache, continued until 9 p. m. when he fell asleep, this despite a nap at 6 p. m.

Column DR-2.—Temperature, 99 in 25 minutes. Only symptom persisting after 4.30 p. m. was general weakness which carried over to test on Aug. 20, 1930.

Column DR-3.—Temperature 99 in 15 minutes, 99.4 in 20 minutes. At 2.30 p. m. normal except for headache and slight weakness.

Column DR-4.—Body and head did not get warm. Machine broke down.

Column DR-5.—The pain comes earlier and is more intense. 2.15 p. m., soreness in wrists and ankles, and weakness, drowsiness, persists with dull headache.

Column DR-6.—The pain in legs disappears with changing position in electrical field. Pain in wrists and ankles developed immediately with weakness. Pain in knees in 20 minutes. Tremor on exertion. Only symptoms at 1 p. m. slight headache and weakness and soreness of wrists, ankles, and knees.

TABLE II.—Section 3.—Observations on exposure of volunteer (Y) to super-high-frequency currents

	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6
Date and hour.....	Aug. 18, 1930.....10.30 11.20	Aug. 19, 1930.....11.30 12.00	Aug. 20, 1930.....11.26 12.01	Aug. 21, 1930.....10.22 10.45	Aug. 21, 1930.....1.27 1.49	Aug. 22, 1930.....11.09 11.39
Temperature, dry bulb:						
Before exposure.....	25 C	26 C	26.5 C	24 C	26 C	21 C
After exposure.....	27 C	26 C	27 C	25 C	26.5 C	21.5 C
Temperature, wet bulb:						
Before exposure.....	17 C	19 C	19.5 C	18 C	18.5 C	14.5 C
After exposure.....	20 C	19 C	20 C	18.5 C	18.5 C	15.5 C
Relative humidity:						
Before exposure.....	44	44	50	55	47	50
After exposure.....	50	50	50	53	44	53
Arrometer:						
Before exposure.....	28.8 29.4	29.86 29.98	30.05 29.84	30.08 29.76	30.08 29.76	30.08 30.04
After exposure.....	28.6 29.2	29.85 29.98	30.05 29.84	30.08 29.76	30.06 29.76	30.08 30.04
Current:						
Kilowatts.....	10	18	18	18	18.5	17
Cycles.....	55,000,000	55,000,000	55,000,000	55,000,000	55,000,000	55,000,000
Body weight, 145						146
Exposure (minutes).....	10 on, 4 off, 35 on; total, 45	30	34	13 on, 4 off, 6 on; total, 19	22	30
First symptom:						
Minutes.....	No antenna held until after 10	Immediately	Warmth immediately.	Warmth and pain in wrist stat.	Warmth and pain an- tenna wrist.	Warmth and pain an- tenna wrist.
Progress.....	Stationary	Progressive		Increase	Increase	
Disappearance current off.....	10 minutes	Immediate		Immediate	Immediate	
Temperature, pulse, respiration:						
Before exposure.....	98.8 84 20	98.4 78 16	98.6 66 16	98.4 72 18	99 72 22	98.3 60 18
After exposure.....	100 88 30		100 84 20		99.4 84 20	100 84 20
Blood pressure:						
Before exposure.....	130/92	130/80	128/88	120/86	124/94	116/92
After exposure.....	118/90		128/94		134/94	134/90
Second symptom:						
Minutes.....	1.00 p. m.	15	Pain legs 5	Sweating 5	Pain in wrist	
Progress.....	Stationary	Progressive	Increase	Increase	Immediate increase	
Disappearance current off.....	During sleep after 9 p. m.	Immediate but grad- ual recovery	Immediate	Immediate	Immediate	
Temperature, pulse, respiration:						
Before exposure.....		12 noon, 99.7 84 20	12.30 p. m., 98.8, 78, 18		1.15 p. m., 99, 68, 20	99.2 72.20
After exposure.....		12.15 p. m., 99.8, 84	1.30 p. m., 120/70		2.15 p. m., 120/90	12.10 p. m., 120/94
Blood pressure:						
Before exposure.....		12 noon, 120/98				
After exposure.....		12.15 p. m., 124/90				
Third symptom:						
Minutes.....	1.30 p. m.		Weakness at 12.05 p. m.			
Progress.....	Steady					
Disappearance current off.....	9 p. m. required as- perlin, in sleep.					

THE DOMINICK-LAUTER METHOD COMPARED WITH STANDARD METHODS IN DIFFERENTIATING THE COLI-AEROGENES GROUP IN WATER ANALYSIS*

By J. M. MCCANTS, Lieutenant Commander, Medical Corps, United States Navy

A vast literature has developed upon the subject of the bacteriological examination of water and upon the sanitary significance of the findings. With a maze of different tests and conflicting opinions it became necessary to standardize the technique.

For many years the American Public Health Association has published its Standard Methods of Water Analysis and has revised the edition from time to time. The bacteriological procedures of Standard Methods may be found in various books on bacteriology as well as in the original source. The tests are in wide use. Hence the technique will not be dwelt upon here except in a general way.

Since it has long been known that to isolate and identify intestinal pathogens from water is a laborious and impractical procedure, Standard Methods attempt to show the mere presence or absence of the coli-aerogenes group of organisms in water to indicate whether such water is fecally contaminated. The test is also in a measure quantitative as well as qualitative, showing the organisms to be present or absent in certain measured amounts of the suspected water. Briefly, the examination consists of a presumptive test requiring 24 to 48 hours, of a partially confirmed test requiring another 24 hours, and of the completed test requiring still another 24 hours. The completed tests, then, according to Standard Methods, consume three to four days' time before a suspected water can be reliably reported as contaminated, although a negative result may be reported in 48 hours. While the presumptive phase of the test can be completed and reported as positive in 24 to 48 hours—sometimes less—this is of no great value because of the fact that relatively small proportions of positive presumptive tests can be confirmed by the further procedures.

Having completed a test according to Standard Methods, it will be observed that we have in a positive test merely demonstrated the presence of the coli-aerogenes group. We have not identified any species nor have we determined whether such species is fecal or non-fecal in origin. It is well known that the coli-aerogenes group of bacteria occur not only in the intestines of man, but also in those of animals and birds, and are widely disseminated in nature—soil, fruit, seeds, etc.

With these considerations it has recently been our custom in doing Standard Methods to proceed a step further and to identify the specific gas-former present in the completed test. Such an organism is usually the *Escherichia coli* or *communior*, but, of course, may be

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any of many species under several genera of intestinal bacteria. Such a procedure for identification of species will require 24 hours or longer. Having identified the species, we have attempted to determine whether such an organism belongs to the fecal or nonfecal group of intestinal bacteria. Now, no one knows just what is meant by a nonfecal colon bacillus (*Escherichia coli*), for instance, but the opinion has been rendered that such an organism is one that has been out in nature for such a prolonged period of time that a change in cultural characteristics has occurred and that the organism has lost its sanitary significance. It may well be, therefore, that to prove a water contaminated with such an attenuated or "nonfecal" organism may save unnecessary worry and expense.

Such tests in use for differentiating between the fecal and nonfecal groups are said not to be entirely reliable, but we have aggregated a total of nine procedures from various sources, have combined their use, and have found them to be reasonably reliable on a small series of analyses. Such tests, however, require four more days for their completion, thus extending a completed bacteriological study of water to a period of at least eight days. The tests now used by us for differentiating the fecal from the nonfecal members of the coli-aerogenes group will be given below.

DIFFERENTIATION OF FECAL FROM NONFECAL GROUP OF ORGANISMS IN WATER ANALYSIS

Reference:

- Standard Methods of Water Analysis, 6th edition, pp. 111-112.
- Preventative Medicine and Hygiene (Rosenau), 5th edition, p. 990.
- Textbook of bacteriology (Ford), p. 810.
- Bacteriology, Blood Work, and Animal Parasitology (Stitt), 8th Edition, p. 223.

1. Having isolated and identified an organism of the coli-aerogenes group, inoculate the following media and incubate for four days:

- (a) Dunham's peptone solution.
- (b) Dunham's peptone solution, plus 2 per cent glucose.
- (c) Medium for methyl red test.
- (d) Smith's fermentation tube of dextrose.
- (e) Tube of gelatin.
- (f) Adonite fermentation tube.
- (g) Saccharose fermentation tube.
- (h) Citrate (synthetic) medium.
- (i) Uric acid (synthetic) medium.

2. After four days' incubation, carry out the following tests on the above cultures:

(a) *Indol test*.—To 5 cubic centimeters of the inoculated tube of peptone solution add 5 drops of vanillin reagent and 1 cubic centi-

meter of concentrated H_2SO_4 . An orange color develops in the presence of indol. (Vanillin reagent consists of 5 per cent vanillin in 95 per cent alcohol.)

(b) *Voges-Proskauer (V. P. test)*.—To 5 cubic centimeters of the inoculated Dunham's peptone solution plus 2 per cent glucose add 2 drops of a 2 per cent aqueous solution of ferric chloride. Now add 5 cubic centimeters of 10 per cent NaOH and shake. In a positive test a deep copper coloration appears in a few minutes at the surface and extends to the bottom of the tube.

(c) *Methyl red test*.—To 5 cubic centimeters of the medium add 5 drops of methyl red indicator. A distinct red color is positive, a distinct yellow color is negative, and intermediate colors are doubtful.

(d) *Determine gas ratio*.—Fill the bulb of the fermentation tube with 2 per cent sodium hydroxide. Place thumb over mouth of tube or insert rubber stopper and mix. The amount of gas absorbed represents CO_2 and that remaining is hydrogen. Having measured the column of gas before and after the process, the ratio can now be determined.

(e) Place gelatin tube in refrigerator or ice water until it solidifies. Now observe any which did not solidify. This portion represents liquefaction.

(f) Observe for acid and gas.

(g) Observe for acid and gas.

(h) Observe presence or absence of growth.

(i) Observe presence or absence of growth.

3. *Interpretation of results*.—Pollution of water by organisms of the colon group may occur from soil, seeds, fruit, leaves, and many other similar nonfecal sources. Hence organisms from such a source do not indicate direct fecal contamination of water. If present in considerable amount, however, the water should be considered suspicious and not certified to on laboratory evidence alone, even though the laboratory evidence indicates the nonfecal group of organisms, for these tests are not entirely reliable.

(a) *Escherichia coli* of fecal origin are gelatin negative, adonite, and usually saccharose negative, methyl red positive, V. P. negative, indol positive, fail to grow in citrate media, and have a low gas ratio. It must be remembered that *Escherichia communior* is a saccharose fermenter.

(b) *Aerobacter aerogenes* of fecal origin.—Gelatin negative, adonite positive, saccharose positive, methyl red negative, V. P. positive, indol negative. The nonfecal *Aerobacter aerogenes* grows in citrate media. Also an *Aerobacter aerogenes* similar to above but failing to ferment adonite is probably nonfecal.

(c) *Aerobacter cloacæ*.—Gelatin positive, adonite positive, saccharose positive, methyl red negative, V. P. positive, indol negative, may or may not be of fecal origin.

NOTE.—For purposes of water analysis, a gram negative, non-sporogenous, rod of typical morphology and producing acid and gas in lactose is considered to belong to the coli-aerogenes group.

The one serious disadvantage of Standard Methods is the time required for the completed test. To wait three or four days to determine whether a reservoir is contaminated means that the water has been consumed by the time that the tests are completed. It is true that the presumptive test may be completed in 24 to 48 hours or less, but since perhaps not more than 25 per cent to 75 per cent of positive presumptive tests can subsequently be confirmed, the procedure is of little value. This is due to the fact that in water there are many anaerobic and aerobic spore bearers capable of fermenting lactose either alone or in symbiotic combinations with certain other bacteria. The *Clostridium welchii* and *B. sporogenes* (old name) are the chief offenders. Furthermore it has been shown by Frost that at certain times of the year anaerobic spore bearers may cause an error in the presumptive test of almost 100 per cent. Hence, in Standard Methods, it is essential to carry the procedures at least through the partially confirmed test and, better, through the completed tests. To go further and attempt to classify an isolated organism as fecal or nonfecal in type simply requires too much time for practical purposes when haste is an essential factor. These tests also are too laborious for routine work in a small clinical laboratory if many water analyses are to be performed. At present, little regard seems to be given such tests because, first, they are not considered to be entirely trustworthy, and, secondly, not too much is known of the sanitary significance of the nonfecal group, it being deemed perhaps better to omit such tests and to err on the side of safety.

Realizing the disadvantages of Standard Methods, Dominick and Lauter have devised a new medium and a new technique for the bacteriological examination of water (Journal American Water Works Association, August, 1929). The method will now be described.

MEDIUM

1. *Strong medium*.—

	Grams
Lactose	10
Peptone	10
Beef extract	5
K ₂ HPO ₄ .3H ₂ O	14.3
KH ₂ PO ₄	2

Dissolve in 2,000 cubic centimeters of distilled water on a water bath. After solution of ingredients add:

	Cubic centimeters
1.6 per cent alcoholic solution of Brom Cresol purple-----	4.0
1 per cent aqueous solution of erythrosin-----	4.0
1 per cent aqueous solution of methylene blue-----	20.0

Tube in 15 cubic centimeter amounts in large Durham fermentation tubes as used in Standard Methods. Sterilize in autoclave at 15 pounds pressure for 15 minutes. The final pH should be between 7.10 and 7.15.

2. *Weak medium*.—This is merely a dilution of the above strong medium and is tubed and sterilized in like manner:

	Cubic centimeters
Strong medium -----	2,000
Distilled water-----	1,200

This medium keeps well and has a beautiful, transparent, deep purple color. Medicinal methylene blue should be used. Other brands tried by us are not compatible with permanency of color.

The dyes and indicators used by Dominick and Lauter in their method are the following:

1. Methylene blue, United States Pharmacopoea, medicinal—National Aniline & Chemical Co. (Inc.), New York, N. Y.

2. Brom cresol purple—Same firm.

3. Erythrosin—Eimer and Amend, New York, N. Y.

Technique.—The water having been collected under aseptic precautions as for Standard Methods, set up a rack consisting of three tubes of the strong medium and three tubes of the weak. Into each tube containing the strong medium place 10 cubic centimeters of the suspected water. Into each of the other tubes place 1 cubic centimeter of the water. Incubate at 37° C. for 24 to 48 hours.

Reading the tests.—In positive tests there will be both gas formation and a characteristic color change. The color change consists of a greenish yellow to a greenish red, the greenish color often being more pronounced in the top of the medium. When all the methylene blue has been reduced, the remaining color is yellow to red. Often the color change is apparent before the appearance of gas and, in heavily contaminated waters, the reaction has been read as positive in so short a time as 12 hours. If the test is to be positive, it is usually so within 24 hours. If not, incubate for a total of 48 hours. Gas without the characteristic color change is considered a negative test. Likewise a color change (usually atypical) without gas formation is regarded as negative. In a positive test there must be gas formation plus the typical color reaction described.

Principle of the test.—The test is somewhat analogous to the reductase test for milk examinations. It appears that only organisms of the coli-aerogenes group are capable of reducing methylene blue to the color reaction cited. When the methylene blue has been reduced sufficiently, the acid color change of the indicator brom-cresol purple (yellow) is brought into view. The erythrosine in the medium is of a reddish color and vigorously inhibits the growth of those lactolytic organisms which do not belong to the coli-aerogenes group.

Dominick and Lauter consider this test to be quick, reliable, and superior to Standard Methods. They have used it for about two years in comparison with Standard Methods and on a large series of water analyses. One of their tables of comparison is given below.

TABLE 6.—*Comparison series*

	Lactose broth (Standard Methods)	M. B.- B. C. P. direct media
<i>Chlorinated water (10 milliliters dilutions)</i>		
Number of tubes.....	65	65
Number of tubes gas positive.....	29	3
Colon confirmed on eosin methylene blue agar.....	1	1
Per cent positive.....	1.5	1.5
Per cent confirmed.....	3.45	33.3
<i>Filtered water (10 milliliters dilutions)</i>		
Number of tubes.....	46	46
Number of tubes gas positive.....	15	11
Colon confirmed on eosin methylene blue agar.....	11	11
Per cent positive.....	23.9	23.9
Per cent confirmed.....	73.3	100.0
<i>Raw water (10 milliliters dilutions)</i>		
Number of tubes.....	21	21
Number of tubes gas positive.....	18	16
Colon confirmed on eosin methylene blue agar.....	16	16
Per cent positive.....	76.1	76.1
Per cent confirmed.....	88.8	100.0
<i>Settled water (10 milliliters dilutions)</i>		
Number of tubes.....	35	35
Number of tubes gas positive.....	30	27
Colon confirmed on eosin methylene blue agar.....	25	25
Per cent positive.....	71.2	71.2
Per cent confirmed.....	83.3	92.9

Colon index determination.—As based upon mathematical formulæ of probability, McCrady has evolved a method of estimating the number of bacteria per 100 cubic centimeters. The method is reliable and easy of application (one merely refers to a table to obtain the index).

Dominick and Lauter apply the method to their test as follows:

1. Set up water analysis routine as previously described. Incubate for 48 hours. Note the number of positive tubes using 10 cubic centimeters of water and the number of positives with 1 cubic centimeter of water.

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2. Refer to the table below for the colon index (number of colon bacilli per 100 cubic centimeters of water).

Using three tubes with each dilution

Positive with—		Number per 100 cubic centimeters	Positive with—		Number per 100 cubic centimeters
10 cubic centimeters	1 cubic centimeter		10 cubic centimeters	1 cubic centimeter	
0	0	0			
0	1	3	2	1	15
0	2	6	2	2	20
1	0	4	2	3	30
1	1	7	3	0	25
1	2	12	3	1	45
1	3	16	3	2	110
2	0	9	3	3	140+

Reference: The Numerical Interpretation of Fermentation Tube Results, M. H. McCrady. Jour. Infect. Dis. 1915. Vol. 17. P. 183.

Leahy, of the Rochester Health Bureau Laboratories, has made extensive comparisons of the Dominick and Lauter method with Standard Methods (Journal American Water Works Association, November, 1930). He comes to the following summary and conclusions:

1. Three hundred samples of water from 91 different sources have been tested by means of Standard Methods of Water Analysis and compared with the new Dominick-Lauter presumptive test (1).

2. It has been shown that the same number of positive samples could be obtained by either method, but that the per cent confirmation was much higher for the new medium than for the standard lactose broth.

3. It has been pointed out that the per cent confirmation for standard lactose broth increased with the dilution, whereas the per cent confirmation for the new medium remained approximately the same.

4. It has also been shown that of the total samples showing a positive presumptive test, 100 per cent were confirmed for the new medium while only 26.9 per cent were confirmed for the standard lactose broth.

5. The new Dominick-Lauter medium was found to be far superior to the standard procedure for the detection of *B. coli* in water.

We have recently had the opportunity of comparing the Dominick and Lauter method with Standard Methods but on a relatively small scale. In short, we have found the method to be quick and reliable. Further work was done along various lines, as follows:

1. Tests were set up using waters known to be negative. The results were negative by both the Dominick and Lauter method and by Standard Methods.

2. Eight strains of *Escherichia coli* or *communior* were isolated from feces and urine. In each instance both methods were positive, using the pure cultures.

3. By a series of dilution tests with a pure culture of *E. coli* it was found that both methods were equal in their ability to detect this organism in high dilutions.

4. Both methods were negative when using a pure culture of *B. mucosus capsulatus* (old name) and of *Alkaligenes fecalis*. This is to be expected, since neither organism is a lactose fermenter.

5. While preparing routine comparative water analyses it was observed that a sample from two sources gave a positive with Standard Methods and a negative with the Dominick-Lauter. The isolated organism in each case was identified as *E. communior* but gave the tests for the nonfecal group. This finding led to further work along this line. Three strains of the *E. communior* were then isolated and gave typical nonfecal reactions. In each instance these pure cultures gave a positive by Standard Methods (completed test) and negative by the Dominick-Lauter method. Likewise four other strains were isolated (three from water and one from urine), but not giving typical reactions for either the fecal or the nonfecal group. We consider them to be borderline organisms. In each case both methods were positive. Also a nonfecal *Aerobacter aerogenes* was submitted by Dominick. This organism gave a positive by Standard Methods and a negative by the Dominick and Lauter method. In all cases mentioned above Standard Methods were run through the "completed tests."

CONCLUSIONS

1. The comparatively new method of Dominick and Lauter is quick, reliable, and superior to Standard Methods in detecting the coli-aerogenes group in water.

2. The medium is stable and easy to make.

3. The technique is simple, can be easily carried out on board ship, and does not require marked ability in laboratory procedures.

4. It is believed that the method is sufficient in itself and thus needs no confirmatory procedures.

5. Our work suggests that the test will eliminate the typically nonfecal group of organisms and thus render unnecessary further elaborate and time-consuming procedures for making such a differentiation. Further work, however, should be done along this line.

6. Further work should be done on the reliability of the tests for differentiating fecal from nonfecal members of the coli-aerogenes group. Further studies are needed on the sanitary significance of the nonfecal members of this group.

POSTVACCINAL ENCEPHALITIS

By W. H. BELL, Captain, Medical Corps, United States Navy

The literature on this subject has been accumulating since 1921 and is rather voluminous. Although information concerning the recognition of such an acute disease of the central nervous system in consequence of vaccination has probably reached officers of the Medical Corps, no instance of its occurrence in the Navy has been reported. This fact may be explained on the basis of overlooked cases, i. e., failure to identify the syndrome with vaccination history, but is more likely to be due to factors which have been recognized as associated with an apparent insusceptibility to the complication, such as previous successful vaccination, age, and sex.

However this may be as regards service personnel, the circumstances are quite otherwise among the families of officers and men, the civil populations in various isolated localities within the United States dependent upon the Navy, and the native populations of our island possessions and other countries where treaty agreements provide for medical service by the Navy. In these fields the conditions are apparently similar to those of the general populations from which cases of postvaccinal encephalitis have been and are being reported.

In an article on the disease by Charles Armstrong, surgeon, United States Public Health Service, published in Public Health Reports, volume 44, No. 34, of August 23, 1929, appeal was broadcast for information concerning its occurrence. The United States Public Health Service through the National Institute of Health (previously the Hygienic Laboratory) has again requested that past or future cases be reported, and to this end and for its own purposes the Bureau of Medicine and Surgery desires the special submission of case records. In its issue of February 1, 1930 (volume 94, No. 5), the Journal of the American Medical Association published a highly valuable discussion of "Postvaccinal Encephalitis and Allied Conditions" by Dr. Simon Flexner. Medical officers are referred to this article as a liberal means to prompt diagnosis or at least suspicion.

For the United States there is a record of 41 cases with several possible additional cases under investigation up to the end of 1930, distributed as follows: 1921, 1 case; 1922, 1; 1923, 2; 1924, 2; 1925, 2; 1926, 1; 1927, 2; 1928, 10; 1929, 9; and 1930, 11 cases. Up to the end of 1930 there is a record in other countries as follows: Holland, 229 cases; England, 139; Germany, 112; Norway, 28; Sweden, 16; Union of Soviet Republic, 2; France, 13; Switzerland, 5; Poland 2; and Portugal and Yugoslavia, each 1 case. The English and Dutch experience with postvaccinal encephalitis is outstanding and is the principal source of our knowledge of the disease. The English in-

terest in the matter was definitely and officially expressed in 1926 when "the then Minister of Health in conjunction with the Medical Research Council, appointed a committee to inquire and report from time to time—

(I) On matters relating to the preparation, testing, and standardization of vaccine lymph;

(II) On the practical methods which are available in the light of modern knowledge to diminish or remove any risks which may result from vaccination;

(III) On the methods of vaccination which are most appropriate to give protection against risk of smallpox infection in epidemic and nonepidemic periods; and to coordinate the work of investigation on these questions in this country and abroad, having regard to corresponding work undertaken by international health organizations."

The committee's first report of February, 1928, embodied 10 specific recommendations largely concerned with methods of vaccination and aftercare. The ninth recommendation, however, suggested continued investigation "with a view to the furtherance of knowledge of vaccinia and of the virus diseases in general, with special reference to the pathogenesis of the nervous complications which occasionally follow those diseases." In particular the committee had recognized the need of close study of the nature, including tissue changes, and occurrence "of acute disease of the central nervous system after vaccination" and made provision for its accomplishment. Its report of September 5, 1930,¹ presents the findings incident to the entire investigation and is in the nature of a composite of present knowledge on the subject for, as contemplated by the instructions issued to the Rolleston committee upon its appointment, information emanating from other countries was embraced by the English study.

A valuable basis for the whole study and such conceptions and tentative conclusions as the committee felt justified to express was its comparison of the number and nature of "alleged ill effects consequent on vaccination" between those cases occurring "before and after the vaccination act and order of 1898 which * * * had introduced far-reaching reforms." It was found that, "although their character remained substantially the same, a diminution in numbers had taken place in all forms excepting those, other than convulsions, relating to the nervous system," and these in their persistence seemed caused by some unknown and intangible factor

¹ Ministry of Health. Vaccination (further report of the committee) observations on the epidemiology and the clinical and pathological character of postvaccinal nervous disease with certain collateral papers. Presented to Parliament November, 1930. His Majesty's Stationery Office, London, 1930.

of viral nature similar to that operating in the production of the corresponding symptomatology and pathology occasionally following variola, measles, and influenza, lending "support to the view that acute disseminated encephalo-myelitis is a disease per se, which may be brought on or directed against the nervous system by certain febrile or exanthematous diseases" as it is sometimes caused by vaccination.

The condition is not to be mistaken for the "nervous complications of a widely different character * * * met with during the stages of defervescence and convalescence from various acute infections. * * * This category may include such definite conditions as bacteriologically proved meningococcal meningitis and acute poliomyelitis." Nor is it to be mistaken for tetanus, as has been done, when trismus happens among the symptoms, or for encephalitis lethargica.

The English investigation so far reported is exhaustive, involving some 90 carefully determined cases, 25 of which were confirmed by post-mortem findings, and including studies of incidence in respect to time, place, family, age, sex, and vaccination history (primary or secondary); of the lymph (vaccine) employed, dosage given, and vaccinator responsible; and of the character of onset, clinical manifestations, and pathological changes, both gross and histological. Information from all sources as regards the several aspects of post-vaccinal encephalitis is quite uniform and the following is a brief summary of our present knowledge of the subject.

Definition.—It is a febrile nervous disease of hyperacute course with a high mortality rate following vaccination within a definite limit of time, appearing irregularly in point of place and time and in disregard of "the incidence of any known factor other than vaccinia by whatever vaccine produced," manifested by signs and symptoms of wide variation in individual cases, "associated with characteristic changes in the brain and cord" and, when ending in recovery, is usually unattended by sequelæ.

Etiology.—The specific cause of the disease remains obscure, but several hypotheses have been advanced on the basis of observations in its epidemiology and deductions drawn from its course and treatment. There is undeniable and definite identification of the disease with vaccination, but the exact nature of this relationship has not been determined. Some suggest that the reaction may be allergic (an existing predisposition or developed sensitiveness); some contend that the vaccine virus merely serves to activate a concomitant though otherwise latent virus or infection of unknown nature; others contend and offer considerable evidence in support of the belief that "postvaccinal encephalitis is a specific effect of vaccine virus." It seems clear from the clinical picture, rarity of sequelæ, failure of at-

tempts to convey to animals, and from the pathology that there is no relation between the incidence of poliomyelitis, polio-encephalitis, encephalitis lethargica or herpes, and that of postvaccinal nervous disease.

Epidemiology.—It usually follows primary but occasionally secondary vaccination as well, and is very rare under one year and in advanced maturity. The youngest of the English cases was 20 months; the oldest 55 years. The school period of life (6 to 13 years) represents the age of greatest frequency for the complication. Girls are attacked slightly more often than boys. There seems to be no relation to the kind or strain of virus used nor to its potency or the dosage as indicated by intensity of local and general reaction. While the dilution of lymph or reduction of insertions is attended "by less marked indications of systemic invasion" the procedure seems to have little or no effect upon the incidence of encephalitic sequelæ. Observations as to this, however, are not sufficiently extensive to warrant conclusions. Many of the cases have followed "takes" running normal courses and which certainly were not unduly severe. A tendency to place and seasonal and familial incidence are mentioned as epidemiological characteristics.

Onset.—This is usually abrupt, within four weeks of the vaccination and with a striking tendency to occur between the tenth and fourteenth day, i. e., at the height of the local reaction.

Symptoms.—The clinical course is a rapid one. Its picture differs widely in different individuals as indicated by the record of the fatal cases in which the diagnosis was confirmed by post-mortem examination. The prodromes are fever, headache, vomiting, and stupor in some cases, deepening into coma. Paralytic effects or sensory disturbance may promptly supervene, involving one or more members or parts of the body. The control of the bladder and rectum is disturbed with resulting retention or incontinence. Reflexes are usually altered.

Pathology.—Gross examination shows congestion of the meninges and punctiform hemorrhages and areas of softening. Microscopically both gray and white matter may be implicated, but the degenerative, exudative, and proliferative process is largely confined to the white matter and seen as a demyelination and infiltration of plasma and proliferated neuroglia cells, particularly surrounding blood vessels. Both the brain and cord are diffusely affected. The areas of tissue involved are without equal intensity and some localities show severe lesions.

Prognosis.—Between 25 and 50 per cent of cases are fatal, but "the severity of onset and early symptoms are not reliable guides to prognosis." The acute symptoms endure for one to two weeks, and,

in patients that survive, the motor and sensory disturbances clear up in a short time. Recovery with restoration of function is usually complete.

Treatment.—This is largely symptomatic and a matter of nursing. The serum of immunized animals has been tried in a few reported cases with indefinite results. Convalescent serum or citrated whole blood from recently vaccinated persons has also been used but with distinctly more encouraging results, although the number of cases so treated is too small to justify confidence in the measure. Such is the prognosis of postvaccinal encephalitis, however, that according to the English view “the empirical use of antivaccinal serum as early as possible after the onset of symptoms pointing to cerebral disturbance is strongly advocated.”

Prevention.—The rarity of cases resulting from vaccinations during the first year of life makes that the period of election for primary vaccination. Indeed, this is the only definite promising precaution to be drawn from experience and studies to date. The experience of The Netherlands has been such that she has temporarily suspended compulsory vaccination except in the presence of smallpox. Germany has liberalized her compulsory laws and made serious vaccination complications compensatable. England has modified the prescribed vaccination technique, recommending *one* small insertion in place of *three* as previously done.

Whether in the course of time technique of vaccination and dosage will prove to have any determining relation to the incidence of postvaccinal encephalitis or not it is only the part of wisdom to exercise the utmost care and nicety in performing vaccinations. Other possible complications give added reason for accurate technique. In this connection attention is invited to the article by Leake and Force² in Public Health Report (volume 45, No. 46) of November 14, 1930 on “The Essentials of Smallpox Vaccination.” Moreover, it is believed that with postvaccinal disease of the nervous system in mind as a possibility, particularly in primary vaccination (probably more particularly primary “takes”), the follow up should be very punctilious and thorough at definite multiple intervals, certainly during the 4-week period within which the development of the symptom-complex is now considered to be limited. In any event the threat against vaccination, the premier among specific preventive measures, as suggested by the action of Holland, Germany, and England is obvious. The Navy should be in position to say positively at any time whether it is or is not having cases of postvaccinal encephalitis.

² Reprinted in April, 1931, BULLETIN.

REPORT OF DENGUE EPIDEMIC IN AMERICAN SAMOA

By W. W. HARGRAVE, Lieutenant Commander, Medical Corps, United States Navy,
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A review of available reports indicates that dengue has occurred from time to time in American Samoa. During late years it has not been considered endemic in these islands. The monthly sanitary report for December, 1911, contains the following: "The epidemic of dengue has continued unabated. No very severe cases have reported for treatment and no measures, except the enforcement of the existing regulations directed against the breeding places of mosquitoes, would prove of value." Monthly sanitary report for April, 1913: "Three cases of mumps and four of dengue were admitted and treated during the month, causing 64 sick days." The monthly sanitary reports for the months of May and July, 1913, show each one admission for dengue. The annual sanitary report for the calendar year 1921 shows eight admissions for dengue. The annual report of the Department of Public Health of American Samoa for the fiscal year ended June 30, 1926, shows two admissions for dengue, and a general report submitted by the governor of American Samoa under date of October 1, 1926, contains the notation, under the heading Communicable Diseases: "A good deal of dengue fever was reported around Pago Pago Bay in September, 1922."

On or about May 1, 1930, a rather explosive outbreak of dengue occurred in American Samoa. Sixty cases were reported on that date from the native villages of Utulei, Fagatoga, and Pago Pago in the immediate vicinity of the United States naval station. The disease assumed epidemic form and spread over the island of Tutuila and the Manua group of islands, namely, Ofu, Olosega, and Ta'u.

There were 2,842 cases of dengue reported among the native population of American Samoa between the 27th of April and the 30th of June, 1930. The following table shows the distribution of cases by districts. It is figured roughly that 20 per cent of the cases were not reported.

District	Population	Cases	Per cent of population
Central.....	3,493	1,190	34.0
Western.....	2,777	693	24.9
Eastern.....	1,351	278	20.5
Ofu-Olosega.....	904	427	47.2
Ta'u.....	1,243	254	20.4
Total American Samoa.....	9,768	2,842	29.0

There follows a table showing the number of cases that occurred among the Navy personnel and their families and the Fita Fita Guard and Band (native Samoans). These cases were all under close

observation and an opportunity was afforded to make a very detailed study. The percentages of "saddleback" temperature curves, rashes, and cases showing definite leukopenia are also given.

	Num- ber of per- sons	Cases	Per cent	Number of saddle back temper- atures	Per cent	Num- ber of rashes	Per cent	Num- ber show- ing leuko- penia	Per cent
White Navy personnel.....	87	32	36.7	25	78.1	21	65.6	25	78.1
Families of white Navy personnel....	108	34	31.5	20	58.8	18	52.9	24	70.5
Fita Fita(native Samoans).....	72	14	19.4	8	57.1	0	0	8	57.1
Total.....	267	80	29.5	53	66.2	39	48.7	57	71.2

The symptoms were comparatively mild in about 35 per cent of the cases, moderately severe in 35 per cent, and severe in 30 per cent. The onset was sudden, with temperature 102° to 104° F. Marked backache, supraorbital headache, eyeball pain or soreness, suffusion of eyes, and general muscle pain, particularly of the leg muscles, were commonly noted. Gastric disturbance was quite a marked factor in a great many cases, characterized by nausea, vomiting, and gaseous eructations. The average duration of illness was about six days. On or about the fourth day the temperature dropped to or near normal for about 36 hours in 67.2 per cent of those cases under close observation, and this drop was followed by a secondary rise, giving the so-called "saddleback" temperature curve. Temperature charts were made on a series of Samoan cases at each of the outlying dispensaries and the "saddleback" temperature curve was noted in about the same percentage of cases as was found in the cases studied close at hand.

As a rule, coincident with the secondary temperature rise, a rash was noted in 48.7 per cent and a leukopenia in 71.2 per cent of the 80 cases shown in the above table. Fourteen of the 80 cases reported on were native Samoans, members of the Fita Fita Guard and Band. The remaining 66 cases were all white Navy personnel or members of white Navy families. No rash occurred among the native Samoan cases, or else it was not recognized, and it may be said that a demonstrable rash was practically absent from all natives seen during this epidemic, a total of 2,842 cases. It is probable that there were rashes among the natives which were not recognized. The rash did occur in a fair number of half-castes. The rash was a macular or measleslike eruption, with a lighter or more reddish hue than is usually seen in measles. It made its first appearance on the dorsum of the hands and feet and spread to arms, legs, and trunk. The rash was more pronounced on the feet and about the knees and elbows. In a large number of cases it was general in its distribution, including

the face, and in other cases the distribution was variable, occurring only on hands and feet or on anterior surfaces of legs and forearms.

In one case the rash appeared only on the face. In two other cases, both females, a definite fairly confluent rash made its appearance only on forehead, extending well back beyond the hair line. After 24 hours duration these two rashes, coincident with the drop in the terminal, or secondary temperature, faded rapidly and were followed by a furfuraceous scale. Thirty per cent of the rashes observed were quite typical of the dengue rash in appearance and distribution, and the others were variations. Itching of the palms of the hands and soles of the feet in natives was noted.

There is given here a clinical chart which shows the characteristic "saddleback" temperature in a case that recurred 21 days after termination of first attack. Severe backache, headache, eye soreness, and leg muscle pains were noted. The typical rash appeared on the fifth day with marked itching of palms of hands and soles of feet. Moderate leukopenia was present, white blood count 4,200, polymorphonuclears 60, and lymphocytes 40. Definite jaundice occurred.

Leukopenia was a constant feature, 71.2 per cent showed a definite leukopenia. The white blood count ranged from 2,800 to 4,800. The differential count showed an increase in lymphocytes; 48 to 54 per cent were this type of cell. Daily blood counts and smears were made, and it was found that the white cell count dropped and the differential lymphocyte count increased from the first day of illness, giving the lowest total white count and the highest lymphocyte count on the third or fourth day of illness. In other words, the leukopenia, including lymphocytosis, was more marked after the disease had existed for a few days. Epistaxis was noted in three cases. Scleral jaundice was noted in two cases. Adenitis was noted in three cases.

From close observation of these cases I am impressed with the fact that dengue is no simple or light disease. Prostration was marked in the severe cases. Loss of weight as much as 12 pounds took place in some cases, particularly in those who had gastric manifestations. Depression, restlessness, insomnia, and general body fatigue were constant manifestations for some time after the disappearance of fever. In young children the pain was much less marked than in adults. It was frequently noted in these young patients that the only pain complained of was a supra-orbital headache at the onset; whereas in adults the backache, headache, eyeball pain, and leg-muscle pain were extremely severe. There were five recurrences within a month among the white population residing on the naval station.

Epidemiology.—Buxton and Hopkins in "Researches in Polynesia and Melanesia (Medical Entomology)," 1927, stated that *Aedes argenteus* (*Stegomyia aegypti*) has been found in Apia, Western Samoa (New Zealand Samoa), for the past 20 years. According to

CLINICAL CHART

Page No.
 Name H. Z. Rate Civilian
 Diagnosis DENGUE Race White Age 29 yrs



our investigations, *Aedes aegypti* (*Aedes argenteus*), the vector of dengue, abounds in American Samoa as well as the *Aedes variegatus*, the vector of filariasis. Other species (identified by U. S. Bureau of Entomology) are: *Anopheles kochi*, *Aedes variegatus*, *Aedes albopictus*, and *Culex fasciatus*.

During the first week of this epidemic the opinion was that we were dealing with influenza. Practically all of the cases during the first week were reported among the natives. As soon as the disease appeared among the white element and a more detailed study was made, where the rash, leukopenia, and other characteristic manifestations were observed, a diagnosis of dengue was established, and on May 10 all district health officers were directed to report all cases of dengue. At this time letters of inquiry were sent to chief medical officers of Apia, Western Samoa, and Suva, Fiji, giving a description of the situation here and requesting information as regards local conditions in their respective territories. Apia is 80 miles from American Samoa. A small boat plies between Pago Pago, American Samoa, and Apia every three weeks, carrying passengers and freight. Intermittent boat trips are also made. Suva, the port of entry for the British Colony of Fiji, is 688 miles away and is the next port of entry after leaving American Samoa. It is on the line of traffic between American Samoa and Sydney, Australia. All Matson Line steamers stop at Suva to and from Australia.

On June 4, 1930, a reply was received from the chief medical officer, Apia, Western Samoa, in which he stated that no cases of dengue had been seen. An extract from this letter follows:

On board the *S. S. Tofua* on April 3 last there were four febrile cases, all Europeans, one of which had a typical dengue rash on the face, arms, and legs. A blood count showed a marked leukopenia in three of the cases. All were isolated on board as far as possible, and no person known to be feverish was landed here, as far as I am aware. Suva's bill of health said "dengue epidemic" without qualifying this in any way.

On June 6, 1930, a reply was received from the chief medical officer, Suva, and parts of this letter are quoted here:

We have had a very extensive epidemic here during March and April of what is, without any doubt, dengue. The disease has run a typical course in most cases, with the usual pains, suffusion of eyes, saddle-back temperature, and, most pathognomonic of all, the characteristic rash. There have been some atypical cases in which the signs and symptoms have been somewhat different, e. g., obstinate vomiting, epistaxis, acute hyperesthesia, etc., but these have been comparatively rare. Of the European population of Suva some 80 per cent have been affected and, although the epidemic is now over, a few cases are still occurring. The epidemic has affected most parts of the colony within a few days' steam or sail from Suva and very large numbers of natives and Indians have been affected.

Under date of June 16, 1930, a further communication was received from the chief medical officer of Western Samoa, from which the following extract is taken:

Since writing to you last week I have seen one definite case of dengue in a European male, a late resident of Suva, and one doubtful one in a European female (blood test this afternoon), also an ex-resident of Suva.

The following extract was taken from a letter received from Suva, Fiji, and written on July 29, 1930, by Dr. S. M. Lambert, deputy central medical authority, Western Pacific High Commission, Rockefeller Foundation:

You undoubtedly have had dengue in American Samoa. Your description of the condition tallies very closely with what we had here, although intestinal manifestations were very marked in some of the cases here. This is the first dengue that I have seen in the Pacific, although I believe that I can show from annual medical reports that it has been constantly with us in Fiji for many years past with the exception of 1927 and 1928. I hope that in the course of the next few months I will be able to work up some material on this subject.

On August 12, 1930, I was informed by Chief Medical Officer Ernest Hunt, of Western Samoa (New Zealand Samoa), as follows: "We have got the dengue here in force, but it is not possible to say how many cases, as our villages are somewhat difficult of access."

It might be well to mention here that a circular letter to the Marist Missions, published in Rome, March issue, came to my attention in which reference was made to conditions in New Caledonia. A part of this letter, describing conditions existing in New Caledonia in January, 1930, is quoted: "There is a terrible amount of sickness here—dengue, grippe, etc." The situation in New Caledonia might have been dengue; and if it was, the disease occurred in New Caledonia in January, in Fiji in March and April, in American Samoa in May and June, and in Western Samoa, in August.

On April 11, 1930, the steamship *Ventura* arrived at Pago Pago, American Samoa, from Sydney, Australia, having made the regular stop at Suva, Fiji. On the 14th, 15th, and 16th of April three cases were reported under diagnosis of influenza from Amouli, American Samoa, occurring in natives who had worked as stevedores on the *Ventura* on April 11. Investigation later showed that these cases were probably dengue. Further cases were reported from Amouli on May 5 and 7, some of which were stevedores. This would make it appear that these men were bitten by mosquitoes on board the *Ventura* and that these mosquitoes got on board in the port of Suva. The greatest number of cases occurred in and about Pago Pago, 60 cases were reported on May 1. Mosquitoes could easily and most probably did come ashore in Pago Pago, and some of those that boarded the vessel could have been bitten, as some of the first cases reported in this port were known to have been aboard the *Ventura*.

We have not been able to trace any of the early cases to passengers from Suva.

On May 2 the U. S. S. *Whippoorwill* made a trip to the Manua group, where passengers were landed from Tutuila. On May 8 three

cases and on May 10 four cases were reported from Ofu-Olosega, one of the Manua group of islands, and these seven cases were passengers recently landed from the U. S. S. *Whippoorwill* from Tutuila. The disease spread slowly in this group and assumed epidemic form the first week in June, reaching the peak on June 7, when 115 cases were reported from Ofu-Olosega.

Influenza.—Influenza was introduced into American Samoa in 1926 for the first time, when it was epidemic. It again occurred in mild epidemic form in 1928. During the year 1929, 327 cases of influenza were reported and 221 cases of pneumonia (all forms) were reported. During the first four months of 1930 the average monthly number of admissions for catarrhal fever, acute, and influenza for all of American Samoa was 212.

In view of the local presence of influenza and the fact that dengue was not believed to be endemic in American Samoa, the present epidemic was believed to be influenza until a sufficient number of white cases had been seen who showed the classical signs and symptoms to warrant the diagnosis of dengue. It might be well to note that there were no respiratory manifestations, such as rhinitis, pharyngitis, or bronchitis, and no intestinal manifestations observed during this epidemic. The absence of these manifestations in such a large number of cases pointed to dengue as the proper diagnosis even before the classical signs were noted in later cases. Again it may be said that the admission rate for pneumonia during the month of May, when the epidemic was at its height, remained low as compared with other months of the year. Influenza is mentioned here only to emphasize the difficulty in distinguishing it from dengue among natives, who either do not have the rash, or, as I believe, in whom it is not recognized. The leukopenia is also helpful in differentiating dengue from influenza. The definite leukopenia and lymphocytosis were constant features.

Summary.—It is difficult to differentiate influenza and dengue in natives in the beginning of an epidemic.

The outbreak was of explosive nature. It affected approximately 50 per cent of the population in two months' time and subsided rapidly, leaving only an occasional sporadic case in its wake.

Gastric disturbances such as nausea, gaseous eructations, and vomiting were frequently observed.

There was an absence of the characteristic pain in young children, except the initial headache.

The higher blood count found in Samoans was probably due to coincident filariasis.

In Samoans rash was absent or unrecognized.

Daily blood counts showed a maximum leukopenia and maximum lymphocytosis on third or fourth day of disease. Total white blood count receded from the first day of illness. Polymorphonuclears diminished and lymphocytes increased from first day of illness.

Recurrences were not infrequent within a few weeks.

Dengue is no simple disease. It gives the impression that the system is carrying a severe toxic load.

No fatalities and no sequelæ occurred.

NOTE.—I am indebted to Lieut. J. F. Finnegan, Medical Corps, United States Navy, for assistance in keeping careful clinical records and to Chief Pharmacist's Mate John L. Inge for working up the statistical tables and for his general assistance.

HEALTH OF THE NAVY

The general admission rate, based on returns for diseases and injuries occurring in October, November, and December, 1930, was 557 per 1,000 per annum.

The corresponding rate for the first quarter of the year was 419; for the second quarter, 606; and for the third quarter, 452. Based on experience in recent years, the expected rate from all causes would be 545 per 1,000 for the last quarter.

The admission rate from disease was 478, which is only slightly greater than the expected rate, 469. The admission rate from accidental injuries, 76 per 1,000, was definitely higher than for corresponding periods of previous years, which is 62.

The incidence of acute respiratory diseases was a little greater than in the corresponding months of the preceding three years, largely due to increased numbers of cases notified as catarrhal fever. The slight increase may have some significance, since epidemics of influenza were occurring in some cities of the United States during November and December and outbreaks began to occur in the Navy shortly after January 1, 1931. The epidemic was of short duration and in most instances the disease was mild in type.

All naval stations in the United States notified only 5 cases of influenza and 398 cases of catarrhal fever for October, November, and December. Excellent health conditions existed at all of the United States naval training stations during this quarter. This may be accounted for by the reduction in recruiting activities. There were 70 per cent less recruits received at the training stations this quarter than during the third quarter of the year. The receiving

station, Philadelphia, Pa., notified two cases of scarlet fever in November, and the United States naval training station, Hampton Roads, Va., one in December.

The admission rate, all causes, for forces afloat was 543 per 1,000 per annum. The median rate for the fourth quarter of the preceding five years is 465. There were 637 cases of catarrhal fever notified from all ships during the third quarter and 950 during the fourth quarter. This disease began to appear in epidemic form on board several ships of the Navy during December. The U. S. S. *Texas* reported 74 cases; the U. S. S. *Arkansas*, 48; the U. S. S. *Memphis*, 36; and the U. S. S. *Pensacola*, 30. Catarrhal fever continued to be epidemic during the remainder of the winter months. The U. S. S. *Cincinnati* reported one case of diphtheria in October.

The Second Brigade, United States Marine Corps, Managua, Nicaragua, reported 11 men killed by bandits in December.

TABLE 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended December 31, 1930

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	74, 114	40, 562	19, 118	114, 676
All causes:				
Number of admissions.....	10, 054	5, 905	3, 095	15, 959
Annual rate per 1,000.....	542. 62	582. 32	647. 56	556. 60
Disease only:				
Number of admissions.....	8, 732	4, 970	2, 705	13, 702
Annual rate per 1,000.....	471. 27	490. 11	565. 96	477. 94
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	1, 927	1, 643	763	3, 579
Annual rate per 1,000.....	104. 00	162. 02	159. 64	124. 52
Venereal disease:				
Number of admissions.....	2, 707	1, 054	728	3, 761
Annual rate per 1,000.....	146. 10	103. 94	152. 32	131. 19
Injuries:				
Number of admissions.....	1, 288	901	370	2, 189
Annual rate per 1,000.....	69. 51	88. 85	77. 41	76. 35
Poisoning:				
Number of admissions.....	34	34	20	68
Annual rate per 1,000.....	1. 84	3. 35	4. 18	2. 37

TABLE 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1930

		Navy			Marine corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	men		
Average strength.....		8, 931	2, 050	84, 074	1, 194	17, 961	511	114, 676
CAUSE: DISEASE								
Primary	Secondary or contrib- utory							
Abscess, perinephritic.....	Calculus, renal.....					1		1
Appendicitis, acute.....	Peritonitis, general, acute.....			1		2		3
	Pneumonia, broncho.....			1				1
Carcinoma, esophagus, stomach and liver.....	None.....					1		1
Cellulitis, general.....	Meningitis, cerebrospi- nal.....	1						1
Cirrhosis, liver.....	None.....			1				1
Cerebrospinal fever.....	Vaccinia.....			1				1
Dilatation, cardiac acute.....	None.....	1						1
Diphtheria.....	Pneumonia, lobar.....					1		1
Encephalitis.....	Cholangitis, acute.....			1				1
Hemorrhage, cerebral.....	None.....				1			1
Influenza.....	Pneumonia, broncho.....			2				2
Nephritis, acute.....	Myocarditis, chronic.....			1				1
Otitis, media, acute.....	Meningitis, cerebral.....			1				1
Obstruction, intestinal, from external cause.....	Peritonitis, general, acute.....			1				1
Paralysis, ascending, acute.....	None.....			1				1
Pneumonia:								
Broncho.....	Lymphadenitis, medi- astinal.....			1				1
Lobar.....	None.....			2				2
	Pleurisy, suppurative.....			1				1
	Septicemia.....			1				1
Purpura, hemorrhagica.....	None.....		1					1
Septicemia.....	.....do.....		1					1
Syphilis.....	Myocarditis, chronic.....			1				1
Tuberculosis:								
Chronic pulmonary.....	None.....			1				1
	Tuberculosis, larynx.....			1				1
Vertebrae.....	None.....			1				1
Typhoid fever.....	Pneumonia, lobar.....					1		1
Ulcer, duodenum.....	Peritonitis, general, acute.....			1				1
Total for diseases.....		2	1	22	1	6		32
CAUSE: INJURIES AND POISONING								
Burns, multiple:								
Oil flames.....	None.....					1		1
Chemical.....	.....do.....			1				1
Drowning.....	.....do.....			4				4
Fracture:								
Compound—								
Skull.....	.....do.....			3		1		4
Pelvis.....	.....do.....			1				1
Simple—								
Skull.....	.....do.....			1				1
	Intracranial injury.....			3		1		4
Vertebra.....	None.....					1		1
Injuries, multiple, ex- treme.....	.....do.....	1		11		2		14
Intracranial injury.....	.....do.....			1		1		2
Rupture, liver.....	Intra-abdominal hem- orrhage.....			1				1

TABLE 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1930—Continued

		Navy			Marine corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	men		
Average strength.....		8,931	2,050	84,074	1,194	17,961	511	114,676
CAUSE: INJURIES AND POISONING—Continued								
Primary	Secondary or contrib- utory							
Wounds:								
Lacerated, neck.....	Hemorrhage, jugular vein.			1				1
Penetrating, chest.....	Hemorrhage, spleen, stomach, and liver.					1		1
Landplane crash: Injuries, multiple, extreme.	None.....	6		2				8
Casualties in action:								
Wounds:								
Gunshot—								
Head.....	do.....					3		3
Chest.....	do.....					1		1
Incised, machete—								
Head.....	Wounds, gunshot:							
	Extremities.....					2		
	Chest.....					1		1
	Chest and shoulder.....					1		1
	Wounds, explosion, bomb:							
	Multiple.....					2		2
	Knee.....					1		1
Homicides: Wounds, penetrating:								
Abdomen.....	None.....			1		1		
Chest.....	do.....			1				1
Brain.....	do.....	1						1
Suicides:								
Wound, penetrating—								
Brain.....	do.....	1						1
Heart.....	do.....					1		1
Poisoning—								
Potassium cyanid acute.	do.....	1						1
Bichloride of mercury.	do.....			1				1
Total for injuries and poisoning.....		10		32		21		63
Grand total.....		12	1	54	1	27		95
Annual death rate per 1,000:								
All causes.....		5.37	1.95	2.57	3.35	6.03		3.31
Disease only.....		.90	1.95	1.05	3.35	1.34		1.12
Drowning.....				.19				.14
Injuries.....		4.03		1.28		4.69		1.99
Poisoning.....		.45		.05				.07

ADMISSIONS FOR INJURIES AND POISONING, FOURTH QUARTER, 1930

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the fourth quarter, 1930, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, October, November, and December, 1930	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1929
INJURIES			
Connected with work or drill.....	821	2,864	2,738
Occurring within command but not associated with work.....	714	2,490	1,818
Incurred on leave or liberty or while absent without leave.....	654	2,281	1,354
All injuries.....	2,189	7,635	5,910
POISONING			
Industrial poisoning.....	19	66	34
Occurring within command but not connected with work.....	36	126	157
Associated with leave, liberty, or absence without leave.....	13	45	37
Poisoning, all forms.....	68	237	228
Total injuries and poisoning.....	2,257	7,873	6,138

PERCENTAGE RELATIONSHIPS

	Occurring within command				Occurring outside command	
	Connected with performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or A. W. O. L.	
	October, November, and December, 1930	Year, 1929	October, November, and December, 1930	Year, 1929	October, November, and December, 1930	Year, 1929
Per cent of all injuries.....	37.5	46.3	32.6	30.8	29.9	22.9
Per cent of poisonings.....	27.9	14.9	52.9	68.7	19.1	16.4
Per cent of total admissions, injury and poisoning titles.....	37.2	45.1	33.2	32.2	29.6	22.7

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from October, November, and December, 1930, reports, are worthy of notice from the standpoint of accident prevention:

Dangerous practice—Cartridge and incinerator.—A cartridge was thrown into the incinerator of a ship by an unknown person. In the resulting explosion a seaman, first class, received a punctured wound of the right eye. Loss of time, 13 days in hospital. He was still under treatment at the end of the year.

Dangerous situation—Standing light broken.—While taking his hammock below, a gunner's mate, third class, fell through a hatch to two decks below and fractured his right ulna. The standing light was out, so the case was reported as "Due to faulty matériel." One day loss of time in 1930. He is still a patient in the hospital at this time (March 25, 1931).

Hatch-cover hazard—unsecured hatch cover.—On account of lack of safety pin, a seaman, first class, received a compound fracture of right index finger and the little finger when his right hand was caught between the hatch cover and the hatch combing while he was descending a ladder. The case was reported as "Due to lack of safety device."

Unsafe practice—Operation of laundry machinery.—A fireman, second class, received a severe crush to the right hand when his sleeve was caught between the rollers while he was cleaning a mangle in motion. Loss of time, 166 days in hospital. He was finally invalided from the service.

Unsafe practice—Open steam trap at station.—A seaman, second class, received a burn of the right leg when he stepped into an open steam trap while walking post on sentry duty at night. Loss of time, 31 days. He was still under treatment at the end of the year.

Lack of safety device—Power-driven machine hazards.—On account of lack of a safety device a marine private received a fracture of the second and third proximal phalanges of the right hand when struck by a board thrown by a power saw. Loss of time, 25 days in a naval hospital.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

Cumulative data

	Number	Per cent of re- cruits received	Per cent of re- cruits reviewed
<i>Jan. 1 to Dec. 31, 1929</i>			
All naval training stations:			
Recruits received during the period.....	13,531		
Recruits appearing before board of medical survey.....	709	5.24	
Recruits recommended for discharge from the service.....	323	2.39	45.56
<i>October, November, and December, 1930</i>			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	260		
Recruits appearing before board of medical survey.....	0	0	0
Recruits recommended for discharge from the service.....	0	0	0
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	236		
Recruits appearing before board of medical survey.....	13	5.51	
Recruits recommended for discharge from the service.....	13	5.51	100.00
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	299		
Recruits appearing before board of medical survey.....	0	0	
Recruits recommended for discharge from the service.....	0	0	0
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	156		
Recruits appearing before board of medical survey.....	14	8.97	
Recruits recommended for discharge from the service.....	3	1.92	21.43

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations.

Color blindness.—Enlisted at Cleveland, Ohio, October 1, 1930. There was red blindness and hesitant green perception and also complete failure with Stilling's test number. Surveyed October 6, 1930.

Otitis, media, chronic.—Enlisted at Milwaukee, Wis., December 1, 1930. The following defects were revealed: Operative mastoid scar on left side, partial obliteration of canal, perforation of drum, and foul smelling, though scant discharge. Surveyed December 9, 1930.

Dental defects.—Enlisted at Milwaukee, Wis., November 17, 1930. Teeth generally unsound; Nos. 1, 4, 16, 17, and 32 missing; Nos. 2, 6, 7, 9, 10, 15, 18, 19, 20, 28, 29, 30, and 31 carious; No. 8 nonvital; and probable pulp involvement in others. There were 21 "restorations" of very inferior character. Surveyed November 22, 1930.

Pyorrhea alveolaris.—Enlisted at Detroit, Mich., October 22, 1930. Marked pyorrhea alveolaris, involving teeth Nos. 4, 12, 13, 19, 23, 24, 25, and 26. There were also insufficient vital serviceable molars; teeth Nos. 1, 14, 17, 18, and 32 missing; Nos. 2, 3, 19, 30, and 31 carious; exodontia indicated in Nos. 3 and 30. Surveyed November 6, 1930.

Organic heart disease.—Enlisted at Pittsburgh, Pa., November 3, 1930. There was a definite systolic murmur transmitted to mid-axillary line associated with marked tachycardia of 150 at rest, 180 after exercise, and poor peripheral circulation. Surveyed November 18, 1930.

Enlisted at Minneapolis, Minn., October 1, 1930. There was a definite systolic murmur transmitted to mid-axillary line associated with enlargement of the heart and tachycardia. Surveyed October 6, 1930.

Arterial hypertension.—Enlisted Cold Springs, N. Y., November 25, 1930. Blood pressure was found to be 154-98 and remained consistently above 148-80 while at rest in bed. There was also tachycardia—100 at rest, 140 immediately after exercise, and 118 three minutes later. The urine showed a specific gravity of 1.030 and a persistent trace of sugar. Surveyed December 8, 1930.

Hypertrophy of mammary gland.—Enlisted at Milwaukee, Wis., October 15, 1930. Definite and palpable enlargement of left mammary gland. This condition was noted at the recruiting station. This man's retention in the service was considered not desirable because of the abnormality of the condition (appearance) and the potentiality of traumatic mastitis and malignancy. Surveyed October 16, 1930.

Acne vulgaris.—Enlisted at Newark, N. J., October 15, 1930. This recruit revealed an extensive acne (papulo-pustular), involving the face, neck, shoulders, and back. The lesions were deep and the scars showed keloid growth. The weight-bearing surfaces of the shoulder were markedly affected. Surveyed October 17, 1930.

Flatfoot.—Enlisted at Richfield, Conn., November 17, 1930. Besides flat feet, the recruit had the following defects: Varicose vein on lateral aspect of left foot at base of third metatarsal, alopecia left side of head (three spots, one 2 inches in diameter), slight scoliosis and lordosis, and rachitic chest. Surveyed November 20, 1930.

Constitutional psychopathic state.—Enlisted September 8, 1930. Upon examination at the naval training station the following defects were noted: Pronounced tic of both buttocks, increased when standing on toes; tremors of fingers; enlarged thyroid; tachycardia and irregular heart action. The recruit complained of nervousness, trembling of limbs, and heart consciousness. He was of adolescent type. Surveyed October 8, 1930.



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AND
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MEDICAL CORPS, U. S. NAVY



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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to the exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes, and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

Surgeon General United States Navy.

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NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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SPECIAL ARTICLES

UNDULANT FEVER (BRUCELLIASIS)

WITH SPECIAL REFERENCE TO 128 CASES IN AND ABOUT DAYTON, OHIO

By WALTER M. SIMPSON, F. A. C. P., Lieutenant, Medical Corps, United States Naval Reserve; Director, Diagnostic Laboratories, Miami Valley Hospital, Dayton, Ohio

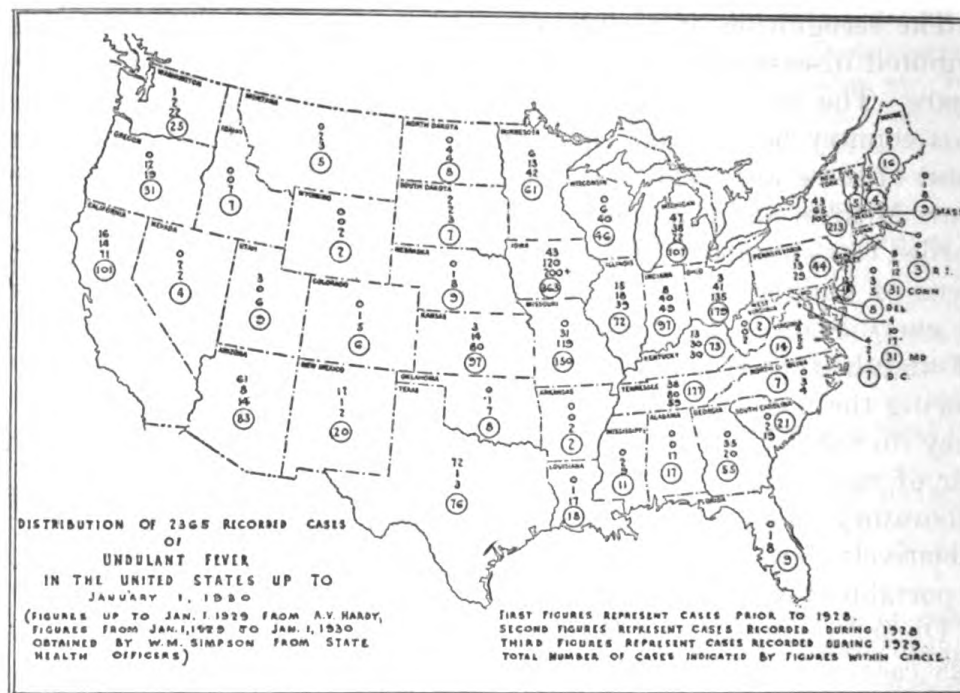
The recognition of undulant fever as a common and widely distributed disease of man is largely a development of the past three years. The occasional sporadic cases which had been encountered in this country before that time were regarded as clinical curiosities; most of these were related to endemic foci of goat infection in Texas, New Mexico, and Arizona. During the years 1927 to 1929 the recorded cases numbered 217, 649, and 1,301, respectively. During 1929 cases of undulant fever were recorded by State health departments in every State in the Union. While it is true that over 2,000 cases of undulant fever have been reported to State health departments during the past two years, these figures are of minimal value, since they do not include the indeterminable but undoubtedly large number of cases which have been recognized as a result of confirmatory laboratory studies carried out in hospitals and private laboratories. Relatively few State health departments list undulant fever as a reportable disease.

During the past two and one-half years the writer has investigated 128 cases of undulant fever in Dayton and the surrounding communities. These findings were the result of a determined effort to learn of the incidence of the disease in a circumscribed locality. Stimulated by a similar motive, Hardy (1) has investigated approximately 400 cases in Iowa. Carpenter (2) in New York, Hudleson (3) in Michigan, King (4) in New York, Bierring (5) in Iowa, Farbar and Mathews (6) in Indiana, Brown (7) in Kansas, Sensenich and Giordano (8) in Indiana, and Ey (9) in Ohio have conducted similar investigations in their localities; their efforts have likewise been rewarded by the discovery of a large number of cases. The inference is obvious that the disease must be much more prevalent than is generally believed.

The first recognition of the disease along the Mediterranean coast produced such synonymous designations as Mediterranean fever,

Gibraltar fever, rock fever, Neapolitan fever, and Cyprus fever. In 1886 David Bruce (10) isolated the organism responsible for the infection; he named the organism *Micrococcus melitensis*. The next great advance in the study of this disease was the application of the agglutination test as an aid to diagnosis by Wright and Semple (11) in 1897. Some 11 years after Bruce's discovery, Bang (12), of Copenhagen, isolated the causative organism of contagious abortion of cattle, which he called *Bacillus abortus*.

A British commission, headed by Bruce, investigated the disease on the island of Malta during the years 1904 to 1907. They demonstrated that the ingestion of raw goat's milk was the common source of infection for man. The prohibition of the use of raw goat's milk



by the men of the military and naval forces produced an immediate and rapid decline in the incidence of the disease. Until very recently Malta (undulant) fever was almost invariably attributed to the ingestion of raw goat's milk or dairy products derived from raw goat's milk.

For 21 years the *Micrococcus melitensis* of Bruce and the *Bacillus abortus* of Bang were regarded as separate, unrelated species, until Alice Evans (13), in 1918, discovered that the two organisms are indistinguishable morphologically, biochemically, culturally, and by ordinary agglutination tests. The results of further studies led Evans to state that the two organisms probably possessed similar pathogenicity for human subjects. In 1927 Carpenter (14) recovered an organism indistinguishable from *Brucella abortus* from the blood

of 10 human beings with undulant fever; 5 pregnant heifers inoculated with these cultures promptly aborted. These observations of Evans and Carpenter have been confirmed by many workers throughout the world. It is now known that the organism which produces contagious abortion in cattle and other domestic animals is capable of producing in human beings a disease clinically and bacteriologically similar to the Mediterranean type of Malta fever.

It became apparent that the *abortus-melitensis* group of organisms should be reclassified. Meyer and Shaw (15) proposed that the organisms of this group should be designated by the generic name *Brucella*; this suggestion has met with universal approval. It is generally accepted that there are three important varieties of *Brucella*. The organism usually associated with infection in goats is called *Brucella melitensis* variety *melitensis*; the organism of contagious abortion of cattle is usually referred to as *Brucella melitensis* variety *abortus*; the organism ordinarily found in swine infections is designated as *Brucella melitensis* variety *suis*. The *Brucella* exhibit marked pleomorphism; coccoid and bacillary forms, as well as intermediary oval forms, are commonly observed. Attempts to divide the organisms of the *Brucella* group into distinct caprine, bovine, and porcine varieties have not been uniformly successful. Organisms which have been designated as porcine or caprine types have been recovered from cow's milk. In the light of present knowledge it seems desirable to refer to all of the varieties as the *Brucella*. Furthermore, the confusion resulting from the many names which have been used to designate the disease caused by *Brucella* in animals and man would be overcome by the adoption of the single designation "Brucelliasis."

Among urban populations the disease appears to be chiefly transmitted through the raw milk of cattle infected with the *abortus* variety of the organism. Of the 128 cases of undulant fever studied by the writer, the ingestion of raw milk containing the organism of contagious abortion of cattle was demonstrated to be the source of infection in the great majority of instances; these findings are corroborated by the investigations of Carpenter, King, Orr, Huddleson, Farbar, Mathews, Sensenich, Giordano, Ey, and others. Hardy, who has conducted extensive studies of the disease in Iowa, expresses the belief that direct contact with infected cattle and hogs has been responsible for a great number of cases of undulant fever occurring in that State. Hardy's investigations lead him to the conclusion that the *abortus* and *suis* varieties of the organism are about equally responsible for the undulant fever morbidity in that State. Hardy (16) has demonstrated by animal experiments that the skin may act as the portal of entry of the organism. Otero (17) of Porto Rico, has reproduced the disease in human volunteers by inoculations

through abraded skin. It is apparent, therefore, that there are two important sources of infection for man, namely, the ingestion of raw milk or unpasteurized dairy products containing the *Brucella*, or direct contact with infected fresh animal tissues.

CLINICAL MANIFESTATIONS IN MAN

Because undulant fever presents many symptoms and signs common to typhoid fever, malaria, tuberculosis, and influenza, it is frequently confused with these diseases. Many physicians have arrived at a tardy diagnosis of undulant fever only after repeated negative Widal reactions, the failure to demonstrate the malarial plasmodium, and the inability to elicit physical signs or röntgenographic evidence of tuberculosis. Less often the disease has been confused with acute rheumatic fever, subacute bacterial endocarditis, bronchitis, pyelitis, or tularemia.

As a result of the more extensive studies which have been made during the past few years, it has become increasingly apparent that a majority of the cases of undulant fever present a more or less characteristic clinical picture. The disease appears to occur predominantly among males, particularly in rural districts. Young and middle-aged adults are most often affected. Children appear to possess some degree of immunity to the disease; 10 per cent of the patients in the Dayton series of cases were children in the first decade of life.

The incubation period has been found to vary from 5 days to 3 weeks; the average incubation period is 2 weeks. The prodrome is not unlike that of any general infection, although in occasional cases the disease is initiated with a chill and a rapid elevation of temperature to 103°–105° F. Ordinarily the patient becomes gradually aware of an afternoon or evening rise of temperature, associated with chills, nocturnal perspiration, and marked weakness. The fever, chills, and sweats usually pursue a characteristic course. The patient usually feels quite well in the morning, particularly in the early stages of the infection. As the daily elevation of temperature develops, usually during the afternoon or evening, the symptoms return. The nocturnal exacerbations of fever occasionally reach great heights (106°–107° F.) The average maximum fever is 103° F. There is often a remarkable disparity between the subjective sense of feverishness and the extent of fever as registered by the clinical thermometer; in many instances the patient does not complain of fever, nor does he present a febrile appearance, but the physician finds, to his great surprise, a fever of 102° to 103° F. As the fever abates, chills and sweating occur. If defervescence is rapid, the perspiration is more likely to be of a drenching character. The chills

are sufficiently severe to be regarded as true rigors in about one-third of cases. There has been no history of chills in about 10 per cent of patients who have experienced fever and sweats.

Marked restlessness and insomnia usually accompany the nocturnal febrile exacerbations. Delirium occurs in some cases, in which the fever reaches great heights. Ordinarily the mental state remains clear during the febrile course of the disease; the so-called typhoidal state is rarely, if ever, observed.

The matutinal remissions and the nocturnal exacerbations of fever may last from one week to several months. The name "undulant fever" refers particularly to recurring relapses of fever. Such febrile relapses appear to be the exception rather than the rule in the recently described American cases; most patients have experienced but one febrile period, lasting from one week to several months, and finally reaching the normal level by lysis.

The essential gastrointestinal complaints are anorexia and constipation. The degree of constipation appears to parallel the severity of the infection. Diarrhea is of rare occurrence.

Loss of weight is an almost constant feature of the disease. Patients experiencing a severe infection will often lose from 25 to 50 pounds in weight.

With the exception of such signs as fever weakness, and loss of weight, there is often a remarkable absence of positive physical findings. The spleen is palpable in about one-third of the cases. Tenderness or pain of the joints or muscles, or both, is likewise observed in about one-third of the cases. The presence of migrating pain in the larger joints has led to confusion with acute rheumatic fever. No permanent impairment of the joints has been observed.

Abdominal pain is a prominent complaint in about 12 per cent of cases; this is most common early in the course of the disease. The pain may be generalized or confined to any one of the abdominal quadrants. In one instance, reported by Bowers and the writer (18), gangrenous appendicitis developed as a complication during the third week of illness. There are many instances on record of needless, and perhaps harmful, surgical intervention in cases of undulant fever in which the abdominal symptoms were a prominent feature of the disease.

Symptoms referable to the genito-urinary tract have appeared in some cases. There is evidence that the organism occasionally exhibits the same predilection for the genital tract of human beings that it does in cows or bulls. Painful swelling of the testes occurs in about 10 per cent of cases. This complication is usually transient, but in occasional instances suppurative orchitis and epididymitis has occurred. In one case reported by the writer (19), *Brucella abortus*

was recovered from a draining sinus tract which extended from the globus major of the epididymis, through the scrotal wall.

There is some evidence that *Brucella* infection may be a factor in certain cases of abortion in women. The literature contains many reports (20) of human abortion occurring on farms where contagious abortion of cattle was common. Kristensen (21) isolated the *abortus* variety of the organism from the exudate which covered the uterine site of the placenta of a 7-month human fetus. Carpenter (22) has recovered the organism from the tissues of a human fetus which was aborted at the end of the fourth month of gestation. Frei (23) has isolated *Brucella* organisms from the vaginal discharge of a woman who had aborted 10 days previously. Other investigators, notably Harbinson (24), Ey, and the writer, have found strongly circumstantial serologic evidence that *Brucella* infection was a factor in the production of several cases of human abortion.

A skin eruption, usually macular or maculopapular, is a relatively infrequent findings; the skin lesions may simulate the roseola of typhoid fever.

Hematologic studies usually yield important information. Some degree of secondary anemia, usually proportionate to the severity of the illness, is almost invariably present. The great majority of cases exhibit leukopenia, with the white blood-cell count ranging from 4,000 to 6,000. A relative, and in some cases an absolute, lymphocytosis usually accompanies the leukopenia. Occasional patients with the mild form of the disease show very little deviation from the normal as regards the blood picture.

The urinalysis usually reveals the trace of albumin commonly found in febrile diseases. The cerebrospinal fluid may show slight lymphocytosis and an increased sugar content, but in most cases shows no abnormalities.

CLINICAL TYPES

Four types of the disease are generally recognized: (1) Intermittent, (2) ambulatory, (3) undulatory, and (4) malignant.

(1) *Intermittent type*.—The majority of cases which have been observed in the United States fall into this group. The disease pursues a subacute course, with fever of an intermittent character; the morning temperatures vary from normal or slightly subnormal to 100° F., while the evening temperatures usually range from 101° to 104° F. The average duration of this type of the illness is from three to four months.

(2) *Ambulatory type*.—Approximately one-fourth of the cases are characterized by a relatively short and mild illness. Many persons in this group will remain at their work, although aware of the existence of mild fever and a marked sense of weakness. The symp-

toms and signs of this form of the disease are essentially the same as in the intermittent type, except that they are much less severe. Such cases are frequently confused with influenza.

(3) *Undulatory type*.—This form of the disease is characterized by the occurrence of relapses. This feature of the disease was said to be of frequent occurrence in the Mediterranean cases, but has been present in only about 15 per cent of the cases which have occurred in this country. The successive relapses usually decrease in intensity and duration. Such cases usually pursue a more chronic course than the other forms of the disease. Physical and mental deterioration are more commonly observed in the undulatory form of the disease than in the other forms.

(4) *Malignant type*.—This form of the disease is rare, having occurred in only about 2 per cent of the cases reported in this country. A sudden onset, an acute course with extreme hyperpyrexia, and a fatal termination in the majority of cases are the characteristics of this unusual form of the disease. The duration of this type of the disease is usually from one to three weeks.

DIAGNOSIS

If undulant fever is given consideration in the differential diagnosis of all cases of febrile illness, especially in those in which the diagnostic criteria for typhoid fever, tuberculosis, influenza, malaria, chronic bronchitis, pyelitis, rheumatic fever, or bacterial endocarditis are not convincing, the disease will be recognized with much greater frequency. This is true in cases of vague mild febrile disease as well as in those in which the clinical manifestations of undulant fever are more clearly defined. In such cases it should become an established practice to submit 4 or 5 c. c. of the patient's blood, collected exactly as for the Wassermann test, to a laboratory equipped with the proper antigens, for the agglutination test. The rapid macroscopic agglutination method of Huddleson (25) is a simple and reliable procedure.

Antiabortus serum agglutinins may appear as early as the fifth day, but in most instances they appear some time during the second week of illness. It is therefore unwise to collect the blood specimen for the agglutination test until a week or 10 days after the onset of illness. In occasional cases agglutinins will not appear until the third or fourth week of illness. The agglutination titer rises to variable heights during the acute course of the disease and tends to fall when the fever abates. Ordinarily, agglutination in dilutions of 1:160 to 1:1,280 will be found during the fourth or fifth week of illness. Many persons will retain antiabortus serum agglutinins for many months or years, while in other cases they will entirely disappear a few months after recovery.

There is convincing evidence that about 5 per cent of individuals with undulant fever, from whose blood the organism may be recovered, fail to develop antiabortus serum agglutinins. Furthermore, some patients who exhibit a well-defined clinical picture of undulant fever, and from whose blood *Brucella abortus* has been recovered, will show agglutination in titers below 1:80. It can not be said, therefore, that there is any arbitrary diagnostic agglutination titer. For practical purposes diagnostic significance is usually attributed to agglutination in dilutions of 1:80 or above. In patients in whom the clinical manifestations are strongly suggestive the absence of agglutinins or the presence of agglutinins in titers of 1:10 to 1:40 should stimulate further serologic and bacteriologic studies. The skin test, using an *abortus* antigen, appears to be of value in differentiating the cases in which agglutinins are absent or are present in low titer.

In rare instances subclinical *Brucella* infections have occurred in persons who have been exposed to the infection; antiabortus agglutinins have been demonstrated in the serums of such persons in the absence of clinical symptoms or signs of the disease. Carpenter, Boak, and Chapman (26) have submitted convincing evidence that antiabortus agglutinins develop only when there has been actual invasion of the tissues by living *Brucella* organisms.

The occasional cross-agglutination of the *Brucella* and *Bacterium tularensis* should be borne in mind. Francis and Evans (27) have suggested that all serums from suspected cases of tularemia or undulant fever should be tested for both antitularensis and antiabortus agglutinins, unless the clinical history points definitely to a recognized source of infection for either undulant fever or tularemia. If it should develop that the *abortus* and *tularensis* titers are the same, or nearly the same, agglutinin absorption tests will distinguish between them. The writer (28) has found *abortus-tularensis* cross-agglutination in 16 of the 88 cases of tularemia and in 20 of the 128 cases of undulant fever which he has investigated.

Since a bacteremia is present in this disease, an attempt to recover the organism by blood cultures should be made whenever possible. Blood for cultures should be collected early in the course of the disease, and preferably at the crest of one of the pyrexial waves. The likelihood of recovering the organism is greater if broth mediums are inoculated directly; the carbon-dioxid requirement of certain strains should be borne in mind.

Urinary specimens for culture should be collected through a sterile catheter. Amoss (29) has recently described a successful method for the recovery of *Brucella* organisms from feces.

Guinea pigs may be inoculated intraperitoneally with the patient's blood or saline suspensions of macerated tissue. Six to eight weeks

should elapse before autopsy. Loss of weight, the presence of enlarged joints, enlarged testes and seminal vesicles, small whitish foci of necrosis in the enlarged liver, spleen, and lymphnodes should be noted. Cultures should be made from the lungs, liver, spleen, kidneys, testicles, and lymphnodes.

PROGNOSIS

Fatal outcome is rare, having occurred in from 1 to 4 per cent of reported cases. The importance of the disease is not to be judged by the death rate. The prolonged course and resulting invalidism make the prognosis much more serious than the death rate would indicate.

TREATMENT

The most important consideration in the control of undulant fever is prophylaxis. The widespread distribution of the infection among cattle renders it difficult to control the infection at its source. While veterinarians and public health workers are striving to check the infection among animals, there appears to be but one logical method for preventing the transmission of milk-borne infection to human beings, and that is by pasteurization. Park (30), Boak and Carpenter (31), and Zwick and Wedeman (32) have demonstrated that complete pasteurization (143°–145° F. for 30 minutes) will destroy the *Brucella*. The need for strict supervision of the pasteurization process is apparent. For the protection of the health of those persons whose occupations bring them in direct contact with infected animal tissues we must rely upon education and the institution of precautionary measures.

The rapidly accumulating knowledge of the widespread distribution of undulant fever has done much to focus the attention of public health workers, veterinarians, and milk producers upon the urgent necessity of eliminating milk-borne infection among human beings. Very little progress has been made in the control of the infection among cattle. While efforts are being made to control the infection at its source, all public health workers should be guided by the advice offered recently by Alice Evans (33):

For the protection of milk consumers the preventive measure is quite obviously the same as that practiced for the prevention of other infectious diseases that are spread by milk, namely, pasteurization. Those who are able to pay the price for certified milk may take raw milk with a reasonable degree of safety, *if the certification guarantees that the milk is from an abortion-free herd*. No milk other than that so certified, or pasteurized milk, can be considered safe, for the cattle disease is widespread everywhere in the United States. It is fortunate that the preventive measure of pasteurization is so easily available.

The treatment of the disease in human beings has been essentially directed toward alleviation of the prominent symptoms. Mercurochrome, acriflavine, neoarsphenamine, quinine, and nonspecific protein therapy have been advocated by several physicians. For the most part these therapeutic observations have not been subjected to adequate control, and the very length of the list argues against the specificity of any of these measures.

Many observers have reported favorable results with specific vaccine therapy. The writer has utilized this form of treatment in 60 cases with results which appear to justify its use. Since undulant fever is often characterized by natural remissions, the value of any therapeutic measure must be interpreted with caution.

REFERENCES

- (1) Hardy, A. V., Jordan, C. F., Borts, I. H., Hardy, G. C.: Undulant fever with special reference to a study of *Brucella* infection in Iowa. Nat. Inst. Health Bull. 158, December, 1930.
- (2) Carpenter, C. M., and King, M. J.: *Brucella abortus* in milk and its relation to undulant fever. Am. Pub. Health A., Symposium on undulant fever, 1929, 1-11.
- (3) Huddleson, I. F.: Is *Bacterium abortus* pathogenic for human beings? J. A. M. A., 86: 943, March 27, 1926; Undulant fever in man and its relation to bovine infection abortion (Bang's abortion disease). J. Mich. State Med. S., 26: 664, November, 1927; Orr, P. F., and Huddleson, I. F.: A further epidemiological study of undulant fever in Michigan. Am. Pub. Health A., Symposium on undulant fever, 1929, 34-38.
- (4) King, M. J.: *Brucella abortus* infection of milk. New Eng. J. Med., 201: 918, November 7, 1929.
- (5) Bierring, W. L.: Undulant fever: Clinical characteristics based on a study of 150 cases observed in Iowa. J. A. M. A., 93: 897, September 21, 1929.
- (6) Farbar, M. E., and Mathews, F. P.: An epidemic of undulant fever. Ann. Int. Med., 2: 875, March, 1929.
- (7) Brown, E. G.: Undulant fever: Report of 62 cases occurring in Kansas. Bull. Kansas State Board of Health, September, 1929.
- (8) Sensenich, R. L., and Giordano, A. S.: *Brucella abortus* infection in man: Report of seven cases. J. A. M. A., 90: 1782, June 2, 1928; Giordano, A. S., and Ableson, M.: *Brucella abortus* infection in man: A serologic study. J. A. M. A., 92: 198, January 19, 1929; Giordano, A. S., and Sensenich, R. L.: *Brucella abortus* infection in man: A clinical analysis of 35 cases, J. Lab. and Clin. Med., 15: 421, February, 1930.
- (9) Ey, L. F.: Undulant fever in Ohio. Ohio State Med. J., 26: 225, 1930.
- (10) Bruce, D.: Note on the discovery of a microorganism in Malta fever. Practitioner, Lond., 39: 161, 1887.
- (11) Wright, A. E., and Semple, D.: On the employment of dead bacteria in the serum diagnosis of typhoid and Malta fever. Brit. Med. J., 1: 1214, 1897.
- (12) Bang, B.: The etiology of epizootic abortion. J. Comp. Path. Therapy, 10: 125, 1897.
- (13) Evans, A. C.: Further studies of *Bacterium abortus* and related bacteria. J. Infect. Dis., 22: 850, June, 1918.

(14) Carpenter, C. M.: Results of injecting pregnant heifers with *Brucella abortus* isolated from man. J. Am. Vet. M. A., 70:459, January, 1927.

(15) Meyer, K. F., and Shaw, E. B.: A comparison of the morphologic, cultural, and biochemical characteristics of *B. abortus* and *B. melitensis*. J. Infect. Dis., 27:173, September, 1920.

(16) Hardy, A. V., Hudson, M. G., and Jordan, C. F.: The skin as a portal of entry in *Br. melitensis* infection. J. Infect. Dis., 45:271, October, 1929.

(17) Otero, P. M.: Quoted by Hardy, A. V., Jordan, C. F., Borts, I. H., and Hardy, G. C. Nat. Inst. Health Bull. 151, 1930, p. 42.

(18) Simpson, Walter M., and Bowers, L. G.: Surgical aspects of undulant fever. Am. J. Surg., 7:597, November, 1929.

(19) Simpson, Walter M., and Frazier, E.: Undulant fever: Report of sixty-three cases occurring in and about Dayton, Ohio. J. A. M. A., 93:1958, December 21, 1929; Simpson, Walter M.: Undulant fever (Brucellosis): A clinicopathologic study of 90 cases occurring in and about Dayton, Ohio. Ann. Int. Med., 4:238, September, 1930.

(20) De Forest, H. P.: Infectious abortion of cattle as a complication of pregnancy in women. Am. J. Obstet. and Dis. Women and Children, 76:221, 1917; Larson, W. P., and Sedgwick, J. P.: The complement fixation reaction of the blood of children and infants, using the *Bacillus abortus* as antigen. Am. J. Dis. Child., 6:326, 1913; Sedgwick, J. P., and Larson, W. P.: Further studies on the epidemic abortion reactions in children. Am. J. Dis. Child., 10:197, 1915.

(21) Kristensen, M.: Ann. de méd., 26:339, November, 1929.

(22) Carpenter, C. M., and Boak, R.: Isolation of *Brucella abortus* from a human fetus. J. A. M. A., 96:1212, April 11, 1931.

(23) Frei, W.: Uebergang des *B. abortus* Bang von Haustieren auf menschen. Schweiz. med. Wchnschr., 59:334, March 23, 1929.

(24) Harbinson, J. E.: Undulant fever in California. Ann. Int. Med., 4:484, November, 1930.

(25) Huddleson, I. F., and Abell, E.: Rapid macroscopic agglutination for the serum diagnosis of Bang's abortion disease. J. Infect. Dis., 42:242, March, 1928.

(26) Carpenter, C. M., Boak, R., and Chapman, O. D.: The significance of *Brucella abortus* agglutinins in human serum. J. Immunol., 17:65, July, 1929.

(27) Simpson, Walter M.: Tularemia (Francis' disease): A clinical and pathological study of 48 nonfatal cases and one rapidly fatal case with autopsy, occurring in Dayton, Ohio. Ann. Int. Med., 1:1007, June, 1928; Tularemia (Francis' disease): Report of four additional cases. Ohio State M. J., 24:860, November, 1928; Tularemia (Francis' disease). U. S. Nav. Med. Bull., 26:825, October, 1928; Recent developments in tularemia (Francis' disease), with a report of eleven additional cases. J. Lab. and Clin. Med., 15:311, January, 1930; Tularemia, 8vo cloth book. Paul B. Hoeber (Inc.), New York, 1929.

(28) Francis, Edward, and Evans, Alice C.: Agglutination, cross-agglutination, and agglutinin absorption in tularemia. Pub. Health Rep. 41:1273, June 25, 1926.

(29) Amoss, H. L., and Poston, M. A.: Undulant (Malta) fever: Isolation of the *Brucella* organism from the stools. J. A. M. A., 93:170, July 20, 1929.

(30) Park, W. H.: Personal communication to the author.

(31) Boak, R., and Carpenter, C. M.: Thermal death point of *Brucella abortus* in milk. J. Infect. Dis., 43:327, October, 1928.

(32) Zwick and Wedeman: Cited by Boak and Carpenter. J. Inf. Dis., 43:327, October, 1928.

(33) Evans, Alice C.: Undulant fever. Am. J. Nursing, 30:1349, 1930.

TREATMENT OF HEAD INJURIES¹

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We see so many patients with head injuries in the Haitian hospitals that we soon come to recognize the commoner types and to treat them with considerable success. There are the cases with profound unconsciousness, fever mounting in a few hours to 105° or 106°, pulse so rapid as to be uncountable, and spinal fluid pressure up to 40 or more, in which we have found no treatment of any avail. There are the cases in which unconsciousness lasts for many days with no other symptoms, many of these patients recovering completely. There are the cases with large depressed fractures producing no symptoms whatever, in which we expect a most favorable result from operative treatment. And there are other less numerous types.

From the many cases seen during my time in Haiti, six have been selected which will serve to illustrate the management of some of the

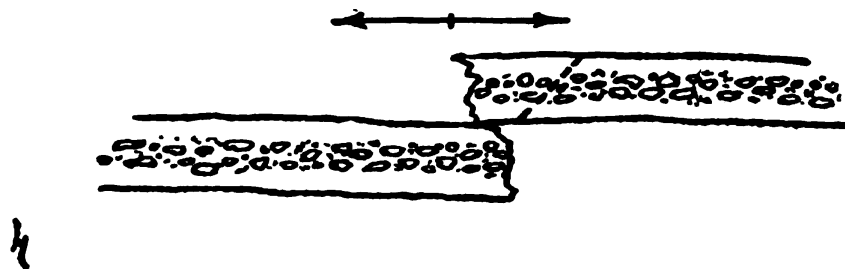


FIGURE 1.—To replace this fracture it would be necessary to apply great force in the directions indicated by the arrow. It is better to chisel away the edge of the upper fragment, as indicated by the dotted line

less common types of head injuries and provide a basis for a discussion of points in their treatment.

CASE I.—A young man of 18 was struck on the head with a machete, producing a linear, depressed fracture of the parietal bone 3 inches long. The lateral edge was depressed beneath the central edge and the wound was badly soiled, with much dirt in the diploë. After recovery from shock he was fully conscious, with no paralysis and normal temperature and pulse. Operation was done about 48 hours after the injury. The position of the fractured portions was as shown in Figure 1.

The usual textbook instruction for elevating a depressed fracture is to drill a hole through the upper fragment and insert an instrument to be used as a lever in raising the depressed portion. That method usually serves for a saucer-shaped depression, but not for a linear displacement. The latter requires a very strong spreading force rather than a lifting force to spring the depressed edge back to position. I know of no way to exert so much force safely and have found it better to chisel away the overhanging edge, after which the

¹ Read at the Fourth Annual Congress of the Haitian Medical Society, Port au Prince, Apr. 9, 1931.

depressed edge may spring back into position or may be raised by an instrument used as a lever, as was done in this case.

Linear depressions are usually produced by a fairly sharp edge and are accompanied by laceration of the scalp and soiling of the wound, which may produce infection. To avoid this, one should chisel away the rough and splintered edges, making a gutter that can easily be cleaned. Free drainage after operation is always necessary, and for this purpose strips of rubber dam are ideal. In the case here described the overhanging portion was chiseled away, the depressed part was elevated, and the gutter formed as shown in Figure 2. Recovery was uneventful and the gutter in the bone was soon obliterated.

We have seen several of these machete wounds in which the anterior wall of the frontal sinus was broken through without penetration through the inner wall. Replacement or removal of the bony fragments with drainage of the sinus was usually sufficient to produce quick recovery.

CASE II.—A boy, aged 8, fell from a tree, striking on his head. He was unconscious for about an hour, and after recovering consciousness he had a persistent headache, for which he was brought to the hospital the next day.

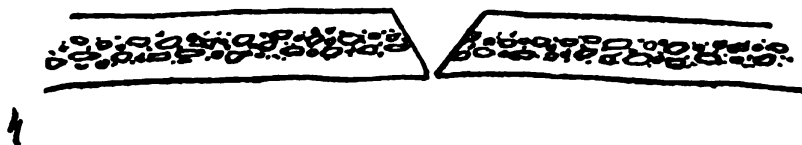


FIGURE 2.—Displacement corrected and edges beveled, producing a gutter which can be easily cleaned and drained

There was a round, punched-out hole in the soft tissues about 1 cm. in diameter. The X ray showed a saucer-shaped depressed fracture about 6 cm. in diameter and $1\frac{1}{2}$ cm. deep, with splintered edges, in the right frontoparietal region. He walked into the hospital and showed no symptoms of brain injury. Operation was done two days after the injury.

Radiating incisions were cut in such a way as to make four flaps, which were raised to expose the depressed area. The overhanging edges of bone were chiseled away until it was possible to get an instrument under the depressed fragments and elevate them. They were found to be so soiled and fragmented that it was thought better to remove them entirely, and so reduce the danger of infection. During the removal of the fragments a large vein in the dura caused most troublesome bleeding. It was finally stopped by cutting a small piece of the temporal muscle and suturing it over the bleeding point. The wound was well drained with strips of rubber dam and very little infection followed.

When the wound is fairly clean and the bone fragments retain some attachment which may provide blood supply, they may be replaced and left in position, but when they are much soiled it is better to remove them. In this country the habitual use of fresh manure as a dressing for open wounds makes us most careful in removing bony fragments and doing a complete debridement. Small

lacerations of the meninges and superficial soiling of the brain seem to be of no great importance. When visible dirt was removed and the wounds freely drained, I have not seen serious infection follow.

These two patients had compound depressed fractures, with no symptoms of pressure or brain injury. In such cases it is not necessary to operate immediately to relieve the depression. One should never operate while shock continues, except to stop visible hemorrhage. It is permissible to wait 24 to 48 hours when a depressed fracture shows no evidence of pressure or brain injury. The late effects observed in some of these cases are probably due to damage done to the brain at the time of injury rather than to the pressure of the bone fragments.

CASE III.—A man, age 43, was injured in an automobile accident. There was a fracture of the bridge of the nose, the anterior wall of the frontal sinus, and the floor of the anterior fossa of the cranium. There was a short period of unconsciousness after the injury. Hemorrhage from the nose was profuse and continuous. Efforts to control it by packing the nares were unsuccessful. The patient, being semiconscious, swallowed the blood and vomited a stomachful from time to time. He was in a small town, without X-ray or operative facilities, where I first saw him about 16 hours after his injury. He was conscious, pale, and both eyes were closed by swelling of the lids. His pulse was weak and rapid, and the continued hemorrhage seemed the most dangerous feature.

After a careful study of the case we decided that it was not feasible to stop the hemorrhage, which was evidently coming from a ruptured vessel within the cranium. It seemed best to keep him completely at rest until his blood pressure fell so low that coagulation could occur. Three or four hours later, when he was pretty completely exsanguinated, the bleeding gradually stopped. After a prolonged convalescence, due to the severe anemia, he made a complete recovery.

This policy of noninterference is advisable in most cases of hemorrhage from inaccessible vessels. By the escape of blood and cerebrospinal fluid from the cranium the patient is saved from the danger of cerebral edema or increased intracranial tension. We have come to regard patients who decompress themselves in this way as being fortunate, for, if they live, they have a smooth and easy convalescence without complications. It is not wise to make any effort to prevent the escape of cerebrospinal fluid from the nose or ears.

CASE IV.—A man, age 19, was injured in an automobile accident and was brought to the hospital within one-half hour afterwards. He was unconscious, with temperature of 102°, pulse 110, and respiration 32. He was very restless, continually tossing and muttering. There was no paralysis and the eye reflexes were normal. The spinal manometer showed a pressure of 18 mm., and removal of 16 c. c. of fluid reduced it to 14 mm.

Two hundred c. c. of saturated solution of magnesium sulphate were given by rectum. Temperature, pulse, and respiration were charted hourly. Eye-ground examinations and blood-pressure readings were made twice daily. The magnesium-sulphate solution was repeated after four hours. The temperature,

pulse, respiration, and spinal-fluid pressure returned to normal within eight hours after his admission, but return of consciousness was not complete for over a week.

Fifty hours after the injury there was a sudden drop of the temperature to 97, of the pulse to 60, and the respiration to 15 per minute, with deepening coma; 50 c. c. of 50 per cent glucose solution were injected intravenously, 200 c. c. of saturated solution of magnesium sulphate were given by rectum, and all preparations for subtemporal decompression were made. Operation proved not to be necessary, for his condition began to improve after the glucose injection, and eight hours later his temperature and pulse were normal. After three weeks in the hospital he was discharged, apparently entirely well.

The X ray in this case, taken after recovery, showed a fracture of the floor of the anterior fossa on the right side, involving the ethmoid, and extending into the wall of the frontal sinus. Such cases require careful watching, with all preparations for quick operation if increased intracranial tension does not yield to hypertonic fluids in the vein and spinal puncture. About 48 hours after injury seems to be a crucial period for many patients, and one should be on the watch for changes in the condition at this time. Very few cases require operation earlier than this.

In this case the sudden change which occurred 50 hours after injury very nearly brought the patient to the operating table, but his rapid response to chemical decompression made it safe to postpone and finally avoid operation. More difficult and important decisions are required—to operate or not to operate—about the 48-hour period than at any other time.

This seems a good place to review the means of cerebral decompression. They are classed as—

Chemical.

Glucose, 50 per cent solution, 50 c. c. intravenously.

Sodium chlorid, 15 per cent solution, 100 c. c. intravenously.

Magnesium sulphate, saturated solution, 200 c. c. by rectum and by mouth.

Mechanical.

Spinal puncture.

Cisterna magna puncture.

Operative.

Subtemporal craniotomy with ventricular drainage.

Suboccipital craniotomy with ventricular drainage.

Temporoparietal bone flap.

The intravenous solutions should be given very slowly, as they produce profound circulatory changes. Glucose has lately replaced sodium chlorid in favor because its action is quicker, more reliable, and much more prolonged. Intravenous glucose with magnesium sulphate by mouth and rectum combined with spinal puncture will obviate operation in the great majority of cases.

If operation becomes necessary, the subtemporal decompression is preferred to the bone flap in most cases, since it is not such a severe operation. A trephine opening is made under the temporal muscle, the ventricle is drained with a hollow needle, and the dura is then incised. The wound should always be drained.

CASE V.—A Syrian, age 37. During the night a thief entered the house and hit this man and his wife on their heads with a large rock while they were sleeping. They were both unconscious until late the following morning, and both lost a great deal of blood. Ten days later they were brought to me because of persistent headache. They had been tending their store in spite of weakness, dizziness, and great pain. Each was found to have fracture of the zygoma and of the skull in the temporoparietal region.

The man had a comminuted fracture 4 by 6 cm. and depressed to a depth of about 2 cm. The scalp wound was dirty and infected. Under ether anesthesia the depressed fragments were removed. The rough spicules along the edges had produced a jagged wound which extended through the meninges into the brain substance. Several rubber dam drains were placed between the bone and the meninges and beneath the temporal lobe.

Great relief from pain was experienced immediately after the operation. A profuse purulent discharge continued for about two weeks, after which recovery was rapid. A year afterwards he was completely well.

This case illustrates the great tolerance of the brain and its coverings for traumatism, continued local pressure, and infection. The depressed bone and the lacerated cortex were in the motor area, but produced no motor symptoms. Pain over the distribution of the fifth nerve was his principal complaint. The effects of a depressed portion of bone are now regarded as much less important than we formerly believed. The persistent symptoms formerly ascribed to the depressed bone are now recognized as being due to cortical damage done at the time of injury. It is remarkable how little permanent damage is done by persistent and profuse purulent discharge which accompanies infection within the brain tissue. I have seen a case (Johnson, L. W., *Surgery of the Supraorbital Region*, J. A. M. A. 86: 14, January 2, 1926) in which such a discharge lasted for a month following a gunshot wound. After removal of the bullet from the frontal lobe the patient recovered without any after effects that we could determine.

CASE VI.—A girl, age 14, was writing on an extemporized blackboard, the heavy slate bed of a billiard table. She fell face down on the floor and the heavy stone fell on her, striking her in the right occipitoparietal region. She sustained fractures in the base of the anterior and middle fossae and a large lacerated wound where the slate struck her.

There was free bleeding from the scalp wound and discharge of cerebrospinal fluid from the nose and one ear. She received the usual treatment and did very well, the temperature, pulse, and respiration being normal at the end of 48 hours. About this time she complained of a pounding headache and soon became unconscious, with pulse of 48, pupils dilated and fixed, then Cheyne-Stokes breathing, and beginning paralysis of the muscles of the glottis. All

of these symptoms developed within a period of about an hour. The spinal fluid was clear and the pressure normal.

With practically no anesthesia we quickly made a trephine opening in the occipital bone, to the right of the mid line, and tapped the posterior horn of each lateral ventricle. There was immediate improvement. She was conscious and recognized my voice before leaving the operating room. Recovery followed without further incident except for diplopia, which persisted for two weeks. Two years later she reported that she was entirely well, with no after effects of her injury.

This was the most dramatic case that I have ever seen. The development of the symptoms was very rapid, and their disappearance, after relief of the intracranial pressure, was even more rapid. It illustrates again the critical period 48 hours after the injury.

Cerebrospinal fluid escaped from the nose and ear for only a short time and autodecompression was incomplete. Since the spinal fluid was not above normal in pressure, we could not decompress the brain by this route, and chemical decompression failed, so operation was the only recourse.

Operation for brain injury is done much less frequently than was formerly the case. Decompression by hypertonic fluids and by spinal puncture has largely taken its place. One should never operate during the stage of shock, when the temperature is subnormal, the pulse above 120, and the blood pressure below 100. Practically all operations for depressed fracture can be delayed for at least 24 hours, and operations for increased intracranial pressure are rarely necessary before 48 hours, so there is plenty of time to study the case before operating.

It is well to have a routine method of treating head injuries, and I suggest the following, which is in use in several of our large hospitals: Take the pulse, respiration, temperature, and blood pressure. If the patient is in shock, treat this first by external heat, morphia, hot fluids by rectum, and perhaps pituitrin hypodermically. Do not disturb the patient or attempt to dehydrate him while he is in shock.

After he recovers from shock give 4 ounces of saturated solution of magnesium sulphate by rectum, or by mouth if he is conscious. Examination and dressing of the wound may now be done and the X ray taken. The temperature, pulse, and respiration should be noted on the chart every hour. Do a spinal puncture and record the pressure. Look for neurologic signs, such as convulsions, paralyses, and twitching.

If the spinal-fluid pressure is considerably above the normal 8 to 10 mm., draw off enough to lower it several points and repeat this every 8 to 12 hours until it remains near normal. If the signs of increasing intracranial pressure become more evident, give 20 c. c.

of 50 per cent glucose solution intravenously and repeat the magnesium-sulphate solution.

Progressively increasing pressure which is not relieved by this treatment will justify surgical intervention unless the symptoms progress so rapidly that death is inevitable. Case VI illustrates the fact that even those in which death is apparently inevitable may occasionally be saved by operation.

FRACTURES OF THE NECK OF THE FEMUR

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"Early treatment is easy. Delayed treatment is difficult. Late treatment is lamentable."—SCUDDER.

The treatment of any fracture should begin the minute the fracture occurs. The treatment of a fracture should not end until the part of the body injured has reached the nearest point to normal function which, in the opinion of the surgeon, can be attained.

The aim in treatment should be an anatomical reposition which will, as an end result, permit normal function.

Every hour lost in the determination of, and execution of, a sound and comprehensive plan of treatment adds weeks to the period of disability and greatly reduces the chances of the optimum result. If, then, fracture results are to be as good as we know they can be, there can be no waiting period in mapping out treatment. To do this, since no two fractures are exactly alike in their implications, one engaged in the treatment of fractures should be familiar with the principles of treatment of fractures, as well as with the methods of applying those principles.

The first objective in treatment should be the reposition of the fragments. Of course, accurate reposition is the ideal but not always the practical. Here it is important to know how much of the ideal can be sacrificed to the practical without the sacrifice of function of the part in the end result.

In the area which we shall consider here, small anatomically, important surgically, and exact functionally, there can be no difference between the ideal and the practical. In fractures of the neck of the femur, regardless of the site of the fracture, exact apposition of the fragments is the only reduction consistent with a good result, and in fractures in this region the results are only of two kinds—good and bad.

While the position of deformity in fractures of the neck of the femur is well known, repetition can do no harm. The distal fragment is displaced upward, rotated outward, and adducted. It is

essentially the position of the dislocated hip. Practically the only inhibiting structure to the displacement of the distal fragment is the joint capsule, and it is this joint capsule which plays so important a part in the accurate reposition of the fragments. In reposition of the fragments it is obvious that the muscle pull, causing the overriding of the fragments, must be overcome to bring the fractured points to the same level. In reduction of the fracture that is the first step. That step involves the correction of the overriding and may correct the adduction and the external rotation. Even with this accomplished we have not replaced the fragments. If you could open the hip joint, you would find that the fractured surfaces are not in contact, and contact of the fractured surfaces is an important prerequisite to union of the fracture. With the muscle pull overcome, manipulation of the capsule and the tendons passing over the joint will accurately put the fractured surfaces in contact. The procedure consists in hyperextending the hip to the limit, thereby tightening the anterior part of the joint capsule, at the same time abducting the hip to the limit and rotating inwardly. Any method of reduction which fails to accomplish these things falls short of accurate reduction and must therefore give poor results. Having secured accurate reduction, that position must be maintained until union has taken place. What method shall be used to maintain the apposition of the fractured surfaces must be determined often by factors remote from the fracture. The plaster-of-Paris long spica is the best and the most satisfactory in the hands of the greatest number of men. This constitutes the so-called Whitman treatment. But it can not always be used. Feeble old people, when put in a cast covering a large part of the body surface, frequently die in a few days. While hypostatic pneumonia is the usual cause of death given, the real cause is that the frail human organism is unable to compensate for the covering up of such a large percentage of the body surface, with its attendant disarrangement of the circulatory and excretory functions.

It might be well to point out here that it is not the number of bandages in a plaster that makes it effective; it is not the plaster itself; it is the result accomplished by the plaster, and if the extremity is not held in that position wherein the fragments are in contact, union can not be expected and the cast is worthless.

The Whitman cast is the method of choice because, if the fragments are accurately replaced and a proper cast applied, very little, if any, treatment is needed until the cast is removed, and the surgeon is free from worry and exacting details. The patient can be turned without endangering the position of the fragments and is ordinarily very happy.

If the patient is feeble, bordering on a circulatory collapse or maintaining life with only a minimum kidney function, the cast is contraindicated. Here the advice of a good internist is essential.

If the cast is contraindicated, then traction, with or without a Thomas splint, and either by skeletal or skin traction, is the next best but decidedly inferior method of maintaining the position of the fragments. Traction with the Thomas splint is preferable to the traction without (which latter is essentially the Buck's extension treatment). Skeletal traction is incomparably better than skin traction and should be the method of choice if traction is used. If delirium tremens is a possible complication to be expected, skin traction should be used until that danger is past, and the usual method of combating that complication should be used before the onset.

There are other methods of treating fractures of the neck of the femur, but they represent only methods of maintaining the position of the fragments until union has taken place. The Cotton impaction treatment, the bone peg, introduced either from the joint end or from the greater trochanter, or the Smith-Petersen nail, introduced in the same manner, are methods which are neither necessary nor desirable as routine measures and can have but a limited application, and then only in the hands of those surgeons who are skilled in the use of surgical means. Having decided upon and carried out a method of reduction and maintenance of reduction, the question of the length of time necessary for union arises. That is variable even in supposedly normal individuals and is usually adversely affected by any disease condition or enfeebled general health. Sufficiently strong union should be present at the end of eight weeks to permit the removal of any apparatus for the maintenance of the reduction. The patient should be allowed to kick around in bed for two or three weeks longer to recover muscle tone and control before being permitted to sit up or to walk. The radiograph, while advisable as a check to clinical findings, is really of little help in determining the strength of union and should not be relied upon.

When the patient is gotten up the fractured extremity should be in a nicely fitting caliper splint and the patient supported on crutches or in a walker.

The patient should be seen by the surgeon at increasingly long intervals for at least six months before being discharged and the end result determined. The radiograph is an important aid in determining the end result, but the clinical examination with particular reference to the function of the hip joint in comparison with the unaffected side is a determining factor in evaluating the result.

Fractures of the neck of the femur are essentially fractures of the aged. When they occur in the robust adult it is usually the

result of a severe injury in which the hip joint is violently forced beyond its normal limits of motion. The fracture is not common in children.

Fractures of the neck of the femur are notorious for their failure to unite. We do not have to go back very far in medical history to find the end of that period in which the fracture was ignored because of the belief that treatment of the fracture was not consistent with the continuance of life in the patient. Buck's extension represented but a step from the "do-nothing" policy, but it was successful in those cases where the extension was adequate and the internal rotation was maintained. The Thomas splint was a still greater advance, because, when properly suspended, it took the work off the muscle groups moving the femur and permitted the control of the distal fragments.

The plaster-of-Paris cast with the extremity in the Whitman position is the most practical for the average surgeon because, if he places the extremity in the position indicated and applies a proper cast, a good result is almost assured without further effort on his part. But it is not the method to which credit is due but to the observance of those principles by which the fractured surfaces are placed and maintained in contact. In other words, the greatest cause of failure to obtain union in fractures of the neck of the femur is failure to bring the fracture surfaces in contact.

Interposition of soft tissues between the fragments, which is a favorite explanation for failure to obtain union, is in reality an uncommon cause of nonunion, especially in fractures of the neck of the femur.

Feeble circulation in the proximal fragment is another theory which has been advanced as a cause of nonunion, but rarefaction in the head of the femur, contrary to being considered an evidence of impaired circulation in the head, should be considered evidence of an efficient circulation, for bone deprived of circulation gives an appearance of increased density to X ray and rarefied bone to X ray is commonly well supplied with blood. The presence of fibrous tissue over the fracture surfaces, instead of being considered a cause of nonunion, should be looked upon as an indication of failure to bring the fracture surfaces in contact. If the fracture surfaces are not placed in contact before the blood clot has organized, that is, within 6 to 10 days, delayed union, if not nonunion, may be expected.

In the operative treatment for nonunion of the neck of the femur, or in any fracture, for that matter, removal of organized fibrous tissue or freshening of the fracture surfaces is absolutely necessary in addition to the application of the principles set forth above for new uncomplicated fractures.

SURGICAL GOITER¹

By K. E. LOWMAN, Lieutenant Commander, Medical Corps, United States Navy

Before discussing the purely surgical aspect of goiter I shall briefly touch upon the anatomy and physiology of the thyroid gland, in order to freshen in our minds the anatomy of the parathyroids and their relations anatomically to the thyroid body.

The thyroid gland, situated at the sides of and in front of the trachea, is more or less symmetrical, consisting of two lateral lobes connected by a narrow strip, the isthmus, which runs across and is rather closely attached to the trachea. The thyroid gland is anatomically placed lower in the neck than the main portion of the thyroid cartilage. The isthmus is said by some authorities to be missing in approximately 2 per cent of persons.

The upper poles of the lateral lobes are usually conically shaped; the lower are thicker and more rounded. The thyroid lies beneath the infrahyoid group of muscles, with the sternomastoid crossing the lower part of the lateral lobes. The carotid sheath lies against the posterior surface and is usually partly external to the thyroid body. The inferior thyroid arteries enter from the inner side into the lateral lobes, while the superiors come more externally and anteriorly into the superior poles. The parathyroids are almost always posterior to the thyroid body and separated from it by the capsule. De Quervain states that there is entirely too much apprehension concerning the unintentional removal of the parathyroids in thyroidectomies. The recurrent laryngeal nerves lie at the inner surface of the thyroids in the sulcus between the trachea and esophagus, the left one actually being in contact with the gland and the right very close to it. Thus we are careful in all operations upon the thyroid to avoid injury to these very important nerves.

The parathyroid bodies, the "epithelial bodies" of many authors, differing from the thyroid body in origin as well as in structure, are small elliptical masses situated always near the thyroid, but separated from it by the capsule. They are said to vary in number from two to seven, but most frequently existing as two pairs, one pair on each side. Symmetry is not, however, invariably the rule as to situation. They usually lie against the posterior surface of the lateral thyroid lobes. But we may expect them at times to be found on almost any portion of the thyroid body, according to Cunningham.

A thyroid gland functioning normally is necessary for the development of the body as well as for the control of general metabolism. For normal function a definite supply of iodine is required. Physio-

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logical activity comprises two chief phases: First, the storage phase, during which colloid is formed and stored in the vesicles; second, the secretory or excretory phase, during which fluid substances other than colloid are elaborated to be released into the blood capillaries or the lymphatics. After each of these phases there is a phase of rest.

The thyroid body is known to possess remarkable functional variation, which enables the organ without permanent derangement to carry on the accelerated metabolism during puberty, menstruation, gestation, and the menopause, as well as that caused by acute infections associated with fever, or induced by severe muscular exertion. Though claimed by some in recent years that the thyroid secretion possesses antitoxic and antibacterial properties, more recent research fails to establish proof of this.

The function of the parathyroid epithelial bodies is not entirely clear. There are definite data, however, from which conclusion is made that these bodies influence profoundly the nervous system (tetany), the metabolism of magnesium as well as that of calcium, and also ectodermal structural growth.

According to many authorities, indications for thyroidectomy have been broadened in recent years because of a better understanding of the relation of the thyroid to many diverse clinical manifestations, particularly cardiac disturbances. Goiters in the middle aged and the aged, apparently harmless over a period of years, have been found with increasing frequency to be the source of active, though often atypical toxic symptoms. Mild toxic manifestations in the young, especially during periods of unusual stress and strain, as in young college girls and at puberty, while constituting very definite evidence of possible future danger, may yield to conservative measures. During pregnancy the basal metabolism is found quite consistently to rise above the average normal and not infrequently to be associated with moderate symptoms, oftentimes bizarre. Iodine will usually relieve such symptoms, or, better still, will prevent their development, when given prophylactically.

The indications for thyroidectomy for thyrotoxicosis are not limited by associated cardiovascular damage or other complications. The existence of such damage may lengthen the period of preoperative preparation, though never for more than a few weeks. No degree of mental aberration is a contraindication. Practically no complications render the condition inoperable.

A rather remarkable difference of opinion exists as to the desirability or danger of preliminary ligation of the four thyroid arteries. The superior thyroids are the ones usually ligated. Some feel that bilateral ligation of the inferior thyroids may endanger the integrity

of the parathyroids. Others have found it entirely safe. Some believe that the safety depends entirely upon the further operative steps that are to be taken.

Surgeons who leave a considerable layer of thyroid tissue in the front and at the sides of the trachea have no fear of bilateral ligation of the inferior thyroid arteries. The collateral circulation is ample for the security of the blood supply. On the other hand, such a method must result in a very high percentage of recurrent thyrotoxicosis in the acute primary toxic types. It is claimed by some that we may not ligate both inferior thyroid arteries and at the same time make a clean dissection of the thyroid from the trachea, and that such a procedure would frequently result in the development of tetany. However, we have been doing this habitually and without seeing any tetany.

The discussion of the relative value and danger of preliminary delivery of the thyroid is based much more on the method of exposure than on any inherent danger in the delivery of the gland. With a satisfactory skin incision and a free median splitting of the strap muscles, most glands of moderate size can be readily relieved of restraining filaments of tissue and can be delivered at will without force. In large goiters, in goiters with unusually long superior poles, and particularly in the presence of substernal or of thoracic extensions, free transverse divisions of the strap muscles between clamps is indicated and widely used. The clamps simplify greatly the control of the ends and their resuture.

The amount of thyroid tissue to be left behind is seldom correctly described, yet it is of vital importance in toxic goiters. In nontoxic adenomatous goiters, if one side is not involved, it may remain intact; however, in large nodular goiters it may be difficult to find sufficient normal thyroid to leave. In thyrotoxicosis there is greater danger of leaving too much than too little.

In toxic goiters only a minimal amount of the thyroid may be left, and the persistence of any degree of toxic symptoms is always proof that too much of the gland has been left behind. A great source of error is the tendency to visualize the amount of thyroid to be removed in terms of a fraction of the size of the gland, such as three-fourths, four-fifths, and the like. It is not the fraction removed but the part left behind which is of basic importance. The amount of tissue required to maintain function is remarkably small, probably only a few grams.

Before the introduction by Plummer of the use of iodine in the preparation of the patient for thyroidectomy, preliminary ligation of one or more vessels was carried out in a high percentage of patients

in some clinics. Lobectomy as one stage of the complete operation is commonly practiced to-day.

The use of iodine has greatly reduced the number of two and more stage operations. Richter (1) sees little purpose in such procedures. The postoperative reaction is due essentially to leaving enough thyroid to develop such a reaction. Moreover, a radical thyroidectomy requires but little more time and inflicts but little more injury upon the patient than an incomplete operation. It would seem logical to remove the thyroid body radically, leaving a minimum of tissue to develop the postoperative reaction so greatly feared.

Lahey (2) holds the view that any goiter which is unsightly should be removed, even though not causing symptoms and not of the variety possessing dangers of malignancy. He urges that any tumor of the thyroid which is low lying and tending to become intrathoracic be removed before it becomes so. Cysts should be removed, as they are not essentially harmless, but may give rise to malignancy. In cases complicated with diabetes or tuberculosis subtotal thyroidectomy is advised.

Dunhill (3) states that the induction of anesthesia for thyroid surgery may be rendered difficult by compression of the trachea; tracheal and bronchial irritation or chronic bronchitis associated with toxic condition, causing heart failure; acute toxicity, causing great mental unrest or extreme tachycardia, or both; or associated conditions, such as uncleanness of the mouth or tonsillar infection.

We have found in our cases that local anesthesia gives a comparatively bloodless operative field, and therefore saves much time during the operation. Also, especially in cases with established auricular fibrillation, local anesthesia undoubtedly is best. Sodium amytal by mouth, 3 grains one-half hour before the operation, in conjunction with local anesthesia, has been found by us to be an ideal combination.

Mild and transient postoperative tetany has not been rare in the reports in the literature, but in practically few cases have generalized convulsions and mental disturbances developed. The tetany is attributed usually to, first, the removal of one or more parathyroids; second, to interference with the blood supply to the parathyroids by edema; third, to disturbance of the blood calcium with consequent alkalosis due to prolonged vomiting. As parahormone has been found to exert only a temporary effect, it is recommended that there be employed the intravenous administration of 10 c. c. of a 5 per cent solution of calcium chloride. In mild cases cod-liver oil has been used with success. Tetany has usually followed total thyroidectomy performed for malignancy. In recent years it has

been determined that radium irradiation gives as good results in malignancy as surgery and is never followed by tetany.

Mild hypothyroidism is common after operation, but is overcome, as a rule, in from three to six months; when it persists longer, thyroid extract may be given to control it.

Hyperthyroidism after operation may be serious. As a rule it subsides in from three to six weeks, but should it persist after three months it is an indication of insufficient removal or recurrence. Seabrook (4) recommends Lugol's solution to control it. If this is not successful, a second operation with more radical removal should be done.

Severe exophthalmos demands painstaking care lest partial or complete blindness result. As a rule, however, recession begins within a few days after operation. Lahey (5) is of the opinion that postoperative management in these cases is very intimately connected with the mortality. Certainly there is no surgical procedure demanding more careful treatment postoperatively than that of thyroidectomy.

When postoperative hemorrhage occurs, greater and greater difficulty in breathing becomes manifest. There is fullness and firmness in the neck. Tension, which when associated with alarming respiratory difficulty, makes the diagnosis evident. Treatment should be instituted quickly and should include opening the wound, cutting the sutures which hold the prethyroid muscles together, turning out the clot, and either packing the wound or deliberately exposing and ligating the bleeding vessel. Venous bleeding, as a rule, does not produce such obstructive symptoms.

The prevention of postoperative thyroid reactions lies in proper preparation before operation. Occasionally, so-called thyroid storms will occur and serve as an accurate index to the refinement of operative judgment. Lahey (2) is convinced that no operative procedure should be undertaken on a thyrotoxic patient until all details of the preoperative and postoperative treatment of the case have been carefully reviewed by the anesthetist, the assistant, and the surgeon.

Occasionally, after the patient has been returned to bed, tracheal obstruction due to pressure occurs. The obstruction may be caused by suturing the thyroid tissue with the neck in the extended position or by the shortening of the prethyroid muscles. Actual tracheal collapse is rare. If considerable degree of interference with breathing exists, the wound should be opened and the obstruction immediately relieved. In other instances a tracheotomy may be necessary and should be employed unhesitatingly. As regards simple postoperative tracheitis, the treatment is steam inhalations.

Injury to one or both laryngeal nerves may cause an urgent postoperative complication. If, in addition to this, a tracheitis is super-

imposed, there will be serious interference with breathing. If there is immediate postoperative difficulty in breathing, a laryngeal examination of the vocal cords should be made. Should paralysis of one cord be noted, there will be no occasion to undertake further measures. Should bilateral paralysis be noted and urgent symptoms appear in the days following the operation, an immediate tracheotomy must be done. Should a bilateral paralysis be present without any interference with breathing, a careful watch should be made in order to determine whether or not it is of temporary nature. If the paralysis exists for three or four months, exploration of the recurrent nerves should be undertaken.

Infection in thyroid wounds, fortunately very rare, is best treated by the introduction of rubber dam drains and the application of hot poultices. Infection beneath the prethyroid muscles is a very serious complication and may spread into the mediastinum. The wound should be opened widely and drains inserted.

The 30 thyroidectomies performed at the Philadelphia Hospital during the past 14 months were done entirely under local anesthesia, which proved eminently successful, particularly when supplemented by the use of sodium amytal by mouth. In this series there were exophthalmic goiters, toxic adenomas, and nontoxic adenomas. No 2-stage operation was performed. There was no mortality.

Each case received very careful preoperative treatment. Lugol's solution was employed in all toxic cases. B. M. R. tests were made frequently. Electrocardiograms were taken in all cases. No case came to operation without first having an examination of the larynx, showing vocal cords to be normal. Naturally, rest in bed was an important part of the preoperative treatment.

At operation Kocher's "necktie" incision was employed. Along with other routine technic it was found that the best procedure in removal of thyroid structure was by sharp dissection, in that it leaves a more clean-cut untraumatized surface. Doctor McMullin has found applicable in some cases a unique operative procedure whereby the thyroid, both right and left lobes, along with the isthmus, is removed by 1-piece resection. First the vessels are ligated on one side after gentle and careful freeing of the poles; then, by sharp dissection, one lateral lobe is excised, and, proceeding via the isthmus to the other side, by careful dissection, the remaining lobe is removed. This novel 1-piece method has given excellent results in certain very large goiters.

In every wound in our series of cases two very small rubber tubes were placed, one in either thyroid fossa, for drainage. Usually these were removed in from 24 to 48 hours. Silkworm for the skin or dermal skin sutures were found to give better cosmetic results than

clips. Postoperatively, 60 minims of Lugol's solution is given in the first proctoclysis. Fluids by mouth—tap water, orange juice, and tea—are allowed almost immediately following operation. Increased fluids and more substantial feedings are progressively added early to the diet. In toxic cases Lugol's solution is given by mouth for 8 to 10 weeks postoperatively. Digitalis is employed when necessity demands. The patient is finally allowed up and about cautiously, and in easy stages.

BIBLIOGRAPHY

1. Richter, H. M.: Thyroidectomy. *Surg. Gynec. Obst.* 49:67, July, 1929.
2. Lahey, F. H.: Deduction from 6,700 goiter operations *New England J. Med.* 200:909, May 2, 1929.
3. Dunhill, T. P.: Anesthesia in thyroid surgery. *Proc. Roy. Soc. Med. (Sect. Anesthetics)*, 21:9, January, 1928.
4. Seabrook, D. B.: Postthyroidectomy complications and sequelae; review of 2,200 cases at Portland Clinic. *Northwest Med.* 28:111, March, 1929.
5. Lahey, F. H.: Management of postthyroidectomy complications. *S. Clin. North America*, 8:13, February, 1928.

WAR-TIME LESSONS APPLIED TO PEACE-TIME WARFARE¹

By WILLIAM S. BAINBRIDGE, M. D., Commander, Medical Corps, United States Naval Reserve; delegate from the United States to the International Congress of Military Medicine and Pharmacy, The Hague, 1931

Although Hippocrates said that "war is the only proper school for the surgeon," certainly no surgeon would voluntarily go to school to war, however great he may believe the benefits that medicine and surgery have reaped from war lessons. What sometimes causes the surgeon to wonder is that the greatest lesson of war for him—the conservation of life—seems to be so little assimilated by the world at large. He wonders at the attitude of the civilian population, which shuddered at the cruelties of war in its incidence of deaths, wounds, accidents, gassings, and illnesses, so complacent in its illusion of peace-time security. War-time imperiously demands that suffering be relieved, a demand which forces surgery and medicine to their utmost effort to reduce suffering to a minimum. The peace-time attitude is much more lax; the reports of civilian casualties, resulting from the mechanization of our lives, filter into the public knowledge without the startling effect of death and disaster of battle. The public has extraordinarily little realization of the extent of peace-time casualties.

A study, however, of the mortalities and morbidities in the United States alone, as reported by the United States Department of Com-

¹ This article was published in the *Archives Médicales Belges*, June, 1931.

merce and the great insurance companies, is a striking comment on human loss in what might be termed peace-time warfare. In spite of thousands of safety precautions and hundreds of statutes for industrial protection, the rate of death in shop and factory, mine and quarry is still very high. The deaths due to accidents in 1926 and 1927 in the United States totaled 214,141; in addition, general disease killed 306,434; epidemic diseases and infections killed 362,557; and the total deaths for all causes in the registration area (with a total population in 1927 of 108,327,000) were 2,522,876. In the three years 1926, 1927, and 1928 in the quarries of the United States 37,228 men were injured, and 408 were killed outright. In the years 1916–1928, inclusive, there was a total of 159,268 quarry accidents. The total deaths in all quarries, coal mines, and metal mines for the inclusive period 1911–1928 were 54,434. In 1927, 15,152 individuals lost their lives through falls occurring in industrial and civil life. The one single greatest producer of accidents in a peace-time world is that necessary convenience of our age, the automobile, which nevertheless enacts the rôle of Juggernaut in our lives. In 1927 the number of people killed by automobile accidents (omitting those in railroad and street-railway collisions) were 21,160. In 1930 more than 32,500 individuals were killed in the United States, and about 1,000,000 were injured in the 135,250 accidents listed in actuarial data. Fully \$300,000,000 in claims was paid by insurance companies for this waste of lives, health and energy, and destroyed property.

In the city of New York alone, with a population of 6,930,446, automobiles killed 1,269 people in the year 1930, a rate of 18.23 per 100,000. In a recent report of the State Traffic Commission of New Jersey it is stated that motor-vehicle deaths in the United States during the last 18 months exceeded the number of Americans killed in action or dying as a result of wounds during the 18 months this country was engaged in the World War. The automobile toll was given as 50,900, compared with the war casualty list of 50,510.

While morbidity statistics are much more difficult to collect than those of mortalities, we can obtain some idea, at least, of the incidence of the morbidity rates of the notifiable diseases. In the city of New York in 1930 the cases of diphtheria, measles, influenza, and tuberculosis totaled 40,186, with tuberculosis alone totaling 11,736 cases. Chronic heart disease had a death rate of 244 per 100,000.

Occupational diseases have always been a part of the problem of industrial life, but never before have they been so rife and so various as at present, when new uses of chemical energy and processes have released new poisons. Even the most recent advance in material comfort—household mechanical refrigeration—has already taken a toll of deaths and illness of its users through accidental inhalation of methyl chloride. In 1926 and 1927 there were 5,348 deaths from

inhalations of poisonous gases from all sources. The morbidity and mortality resulting from the ingestion of insoluble sulphates of radium, mesothorium, and radiothorium are well known; these have taken the form of anemias, jaw necroses, and various types of crippling bone lesions. It was stated by Sir Thomas Oliver, on his visit to the United States some years ago, that in northern New Jersey there was a larger number and variety of industries in which occupational poisoning could exist than in perhaps any other known equal geographic area in the world.

The facts thus set forth out of a multitude of statistics are certainly startling enough to bring home to us that life is a permanent warfare with its inevitable loss of human beings. This is especially evident in those years, as in 1918, when the annual incidence of influenza rises to epidemic proportions and the country becomes a vast camp armed to combat a mortal enemy. Nevertheless, the conditions of life at large slowly improve, due to the application of lessons of preventive medicine and surgery, sanitation, and hygiene—knowledge gained primarily often under the very guns of war, and then more leisurely developed in times of peace.

A glance at the benefits wrested from wars in the past recalls the work of Larrey in the Napoleonic wars. Larrey, one of the most remarkable military surgeons who ever lived, had a record of 75 to 80 per cent of recoveries after major amputations, something then new to history. By devising the so-called "flying ambulance," used for the first time on any battlefield, Larrey was enabled to operate frequently as soon as 15 minutes after injury. The great number of *mutilés* with wooden legs, a common sight during the first part of the nineteenth century, was an illustration of the success of his methods and the truth of his theory that the activity of the surgeon began with the first cannon.

Probably the most outstanding benefit to humanity ever wrought out of war was the creation of the "greatest mother," the Red Cross Society, which found its inception in the horror of a noncombatant witnessing the agonies of the wounded left to perish on the battlefield of Solferino. From the first international meeting of the small Red Cross Society of 1863 the organization has grown to be one of the greatest beneficent world agencies with the declared object of the relief of suffering humanity. Its peace-time activities are well known throughout the world wherever an epidemic or disaster from any cause has attacked the population.

Similarly, the American Civil War made its contributions to science in presenting the first account of trench nephritis, in Da Costa's work on irritable heart in soldiers, and the epoch-making studies of Mitchell, Morehouse, and Keen on the effects of gunshot injuries of nerves. According to Garrison this was "the starting

point of the recent studies of Marie and his associates on gunshot injuries of the peripheral nerves."

The Spanish-American War resulted in the wiping out of yellow fever by General Gorgas in Habana and the Canal Zone. Almost at the same time army surgeons of other nations—Laveran, Grassi, and R. Roos—succeeded in their battle against malarial fever.

One of the most striking triumphs of science and preventive medicine over disease was that in relation to typhoid and paratyphoid fevers. This resulted from experiences in the Spanish-American and Boer Wars, in both of which more men died from enteric fever than from wounds. The Russo-Japanese War, when soldiers were inoculated against typhoid, showed such a striking contrast that when the World War broke out men were vaccinated as soon as they enlisted, with the result that, at the end of 16 months, from among upward of 2,000,000 British soldiers there were but 18 deaths from enteric fever. Sir Almroth Wright and General Leishmann by giving immunity to the British Army gave it likewise to the whole world.

In the World War the benefits reaped by medicine and surgery approached the revolutionary, and even to-day their continued and increasing value can hardly be measured. As stated by Crile, "Much has been learned as to sanitation, acute wound infection, treatment of fractures, nerve suturing, plastic surgery, and the relation between the organism of man and the destructive forces that surround him." The cumulative experience of the surgery of all time, from Ambroise Paré to Larrey and from Larrey to our own day, was dramatically presented to the surgeon in the World War. To this knowledge were added the modifications and new techniques developed by the emergencies of war in an age of science. In the treatment of wounds, techniques as sharply contrasting as those of immediate closure, a revival from the sixteenth century, and the Carrel-Dakin antiseptic treatment were used simultaneously. The necessity for exact knowledge of the period of contamination, of infection, and dissemination in the treatment of wounds foreshadowed by Paré over 300 years ago was rediscovered and developed during the World War. Débridement, which Paré described as the removal of every particle of mortified tissue, was utilized in its fundamental principles but with changed technique by French Army surgeons.

In the treatment of chest wounds more radical procedures have replaced the old expectant treatment so long practiced in civil life. Duval, Carrel, Depage, and Tuffier were pioneers in obtaining primary sterilization of the pleural cavity in treating infected cases of closed hemothorax. Tuffier wrote in 1918, "Surgical tendencies are now exactly contrary to those which formerly prevailed; the thoracic

cage is no longer placed before the lung in importance, and the lung must always be considered before the chest wall. The advantages are considerable for the functional future of the patient; the lung resumes its normal activity, whereas in the old methods of treatment everything tended to destroy it." In times of peace with these new techniques the patient has a far greater chance than the soldier had, since there is opportunity for the particular care demanded in the treatment of gunshot wounds. In Tuffier's underground hospitals the writer had the privilege of observing the excellent results derived from immediate care of the wounded directly at the front without the delay of transportation.

The war gave us studies of tremendous magnitude in the fields of penetrating wounds; of fractures; of joint lesions, where the work of Willems is outstanding; of amputations; of plastic surgery. In compound fractures shortening is reported as reduced to an average of one-half inch. There are new regulations as to amputations for leg, thigh, and lower leg. The use of splints has been perfected and standardized. Crutches, in a measure, have been done away with by the use of provisional apparatus, and artificial limbs are greatly improved, with the old steel and leather leg gone for good. General reconstruction has reached new high levels; in this work use has been made of the formerly not generally utilized physiotherapy, the application and development of which in all its branches attained merited recognition as a result of the World War. Similarly, occupational therapy, functional reeducation, and vocational readjustment gave an entirely different outlook on life to the mutilated and disabled. It is interesting to note that many so-called reconstruction hospitals, which arose out of the needs of the war, have remained as permanent institutions to serve the community during peace.

In addition to the great advances in general surgery and the development of orthopedic surgery into a specialty, brilliant strides have also taken place in the field of neurological surgery; there is new knowledge of the treatment of peripheral nerve injuries from the clinics of Dejerine and Pierre Marie; studies were made of acute cerebellar lesions and occipital lobe injuries by Gordon Holmes; a complete revision has been brought about in the knowledge of section of the spinal cord through the studies of Head and his coworkers on the mass reflex, automatic bladder, and other phenomena accompanying spinal-cord transection.

The recognition of the need of cooperative work between the general and dental surgeon was made manifest in the World War, with its vast number of jaw and face wounds involving loss of bone, teeth, and soft parts. Such coordination of effort is of vital importance at all times—in war and in peace.

In the field of medicine the study of great groups of patients has increased our knowledge of the heart, lungs, and pleura; war has increased our knowledge of the hysterias, neurasthenia, and epilepsy. The study of syphilis has, at least, been brought out from under cover and the civilian population informed of its prevalence and disastrous consequences. Other fields in which our knowledge has broadened are those of nephritis, functional cardiac disorders, the effort syndrome, and fatigue poisons. Conclusion has been reached that tuberculosis is no more likely to occur in lung tissue that has been gassed than in lungs not so exposed; this decision has had a far-reaching effect in relation to compensation legislation.

Advances in the field of sanitation have already been referred to in relation to typhoid fever. Camp dysentery, the scourge of the American Civil War, was stamped out on the European battlefields.

The above brief review, which can touch only at the most outstanding points of the new knowledge reaped by medicine, surgery, and sanitation in the years 1914-1918, describes almost a new birth of these sciences. From the terrible totals of loss of the World War we must subtract this great benefit which has come to humanity.

The writer has attempted to elucidate in this paper the fact that the conditions of peace and war, so dissimilar in their general aspects, are very similar in their lists of casualties. Peace, in its vast, diversified enterprises of industry and commerce, is built on a perpetual warfare inherent in the struggle of man with machinery and the elements. Injuries, accidents, infections, poisonings, and disease, differing only in their degree of concentration, are at times about equally common to peace and war. The lessons learned by physicians and surgeons in the concentration of casualties in all the armies of the World War are being applied to-day for the benefit of civilian populations. The diffusion of this knowledge is of international importance and demands the close interrelationship and intercommunication of various peoples which modern transportation, the radio, and other devices are making possible. Each country needs all that the others have to give. In line with these requirements the work done by the International Congresses of Military Medicine and Pharmacy is accomplishing the aim for which the congress was founded. This aim, as stated in the official report of the Paris congress, 1925, is "to codify and standardize methods in the prevention and treatment of disease and in the care of the sick and wounded, not only during war but in peace time as well." The conclusions drawn from the material submitted by the various countries represent the knowledge and practical experience of the medico-military profession as a whole. To quote from the report of the Fourth International Congress at Warsaw, "The success of the congresses

is almost predetermined by their high purposes—to internationalize all knowledge in the healing art to save life and limb, to foster brotherhood, and so draw nations together by a tie of deep humanity.”

The meetings of the International Congress of Military Medicine and Pharmacy at The Hague in June of this year ushered in the tenth anniversary of their initiation. It was a wise vision of great leaders to assemble the experiences gained in the greatest clinic the world has ever seen. Belgium deserves the credit for the inception of the congress. Of all those who have made it possible and who have contributed to its wonderful success, no one deserves greater credit than its enthusiastic, indefatigable, efficient, and permanent secretary, Maj. Jules Voncken.

TOXIC AMBLYOPIA¹

By J. J. WHITE, Lieutenant Commander, Medical Corps, United States Navy

“Amblyopia” is used to denote dimness of vision, especially that form not due to refractive errors or to organic disease of the eye. In the vast majority of cases the condition is devoid of ophthalmoscopic or other marked objective signs.

Toxic amblyopia is the variety which is produced by tobacco; may be produced also by alcohol, quinine, stramonium, cannabis, and other drugs. Tobacco and alcoholic amblyopia, which are the forms most frequently met with, are usually described as forms of retrobulbar neuritis, but experimental and pathological evidence tends to show that the condition is primarily retinal.

Tobacco amblyopia results from the excessive use of tobacco, either by smoking or chewing, and occasionally from the absorption of dust in tobacco factories. It was formerly thought that alcohol was practically always associated with tobacco as the cause, but it is now well accepted that either tobacco or alcohol alone may produce this condition.

In the cases being reported the patients complained of defective vision, many stating that the vision seemed to be better in the evening or in a dull light. The patients stated also that they had consulted different ophthalmologists, with little or no satisfaction afforded by the refractions. It has been reported that in many cases congestive haze of the edges of the optic disk, followed by pallor of the temporal side of the disk, was noted, but in our series of cases no such changes were observed. The course is chronic and the

¹ From Department of Aviation Medicine, Naval Medical School, Washington, D. C.

prognosis, as a rule, good, if the toxic agent is discontinued absolutely.

The disease is probably due to poisoning of the ganglion cells of the retina. In experimental cases and in one clinical case the ganglion cells showed vacuolation and breaking up of the Nissl granules. This leads to degeneration of the nerve fibers, demonstrated only after their medullary sheaths have undergone change. The degeneration is found to be limited to the papillomacular bundle.

The ganglion cells of the fovea and macular regions are the most highly differentiated and are likely to suffer first and most severely in any toxic condition. The degeneration, therefore, occurs in a wedge-shaped area on the temporal side of the nerve, immediately behind the globe, but this site becomes a circular central area most posteriorly and an oval central area near the optic chiasma. This degeneration was discovered early in the history of the disease and, with its clinical resemblance to undoubted cases of retrobulbar neuritis, led to the conclusion that its area was the primary seat of the disease instead of the ganglion cells of the retina. This is the view generally accepted to-day.

By examination with the perimeter at the Naval Dispensary and Naval Medical School a definite reduction of the visual fields for color was noted in each case of a series of 150 patients who were smoking more than one package of cigarettes daily. This reduction was more marked in the women than the men. The reduction of the fields for form was very slight. Contrary to the findings in most reported cases, no enlargement of central scotoma was noted in this series. The color-field reduction was almost paralleled in this series by the reduction in accommodation.

CONCLUSIONS

1. Toxic amblyopia is not considered a retrobulbar neuritis, but due to the effect of the toxic agents on the ganglion cells of the retina.
2. It is apparently much more common than hitherto realized. These patients, especially women (too often classified as neurotics), go from one ophthalmologist to another seeking relief for visual disturbance.
3. In view of the great increase in tobacco smoking, particularly among women, all cases with obscure eye symptoms should be examined as to color fields with the perimeter.

THE DEVELOPMENT OF DENTAL OFFICERS FOR RESPONSIBLE POSITIONS

By W. REHRAUER, Lieutenant Commander, Dental Corps, United States Navy

In recent years there has been a tendency toward specialization in dentistry. In civil life many dental practitioners consider that the opportunities for success are increased by specializing rather than engaging in general practice.

Some naval dental officers, from their association with civilian dental practitioners, no doubt likewise feel that specialization will bring them greater professional attainment—with its various attending rewards.

Should each dental officer be permitted to limit his work to some special phase of dentistry, the Naval Dental Corps would soon fail to fulfill its mission.

The policy of the Dental Corps may be defined as "the greatest good for the greatest number." Those who have the greatest practical skill and best theoretical knowledge of all branches of dentistry may be considered the successful ones from the viewpoint of naval dentistry.

If the Dental Corps of the Navy is to make progress in efficiency and the dental service, which is its responsibility, is to be practical, well balanced, and the best that can be provided, dental officers must be broadly educated in *all* branches of dentistry and indoctrinated in the theory of being first rate *general* practitioners.

How can dental officers who have not actively practiced all branches of dentistry understand the problems involved in the various subjects of the profession? How can they, when the time comes and the rank requires their services in such capacities, successfully administer our larger activities, which require not only executive ability but a broad knowledge of all phases of dentistry? Executive ability in such capacities, while desirable and necessary, would not of itself be sufficient. Dental officers must know the problems of all the branches of dentistry if they would be whole-heartedly respected by those subordinate to them.

A general knowledge of dentistry can, of course, only be acquired by seizing every opportunity offered in the way of practice in the various branches.

Since 1922 the activities of the Navy Dental Corps have been gradually expanding. In that year the dental department of the United States Naval Medical School was created. Since then there have been established prosthetic laboratories in increasing number and importance at various naval stations. Dental wards have come into existence at some hospitals. All dental activities will continue to grow in size as well as in the responsibilities involved.

If the efficiency of naval dentistry is to continue and expand with the rapid advancement of dental science, men must be developed from the Navy Dental Corps—men of vision and of wide experience in *all* branches of dentistry.

The Navy Dental School gives officers of the Navy Dental Corps opportunity to acquire basic foundations upon which to build reputations as successful general dental practitioners and to prepare themselves for greater responsibilities.

The mission of this school is to give postgraduate instruction in all branches of dentistry and indoctrinate the students in the fundamental necessity for being *general* practitioners.

The curriculum is so planned that no undue importance is given to any particular subject. Endeavor is made to give thorough practical and theoretical basic instruction in all the various subjects and sufficiently comprehensive to enable the student officers to apply their knowledge to daily routine practice.

Underlying the entire curriculum is the indoctrination of an ambition for continued future study and perfection of technique in all branches of dentistry.

Some dental officers will give evidence of outstanding ability in certain specialties. It is also true that officers on the teaching staff of the Navy Dental School are specialists in their various branches, but rotation of duty demands that they be general practitioners of quality.

There is good reason for this idea of developing outstanding general practitioners. From among this type of dental officers there must be selected those men who will be in charge of our dental division in the office of the Surgeon General, the officer in charge, and the instructors in the Navy Dental School, those who are to assume the responsible positions at our prosthetic dental laboratories, our hospitals and dental wards, and at the supply depot. The question might be asked, "Why the officer in charge of dental supplies at the supply depot?" The answer is, "How can supplies for such diversified activities as general dental practice and for an organization so large as the Dental Corps be selected intelligently unless the officer having that authority has had actual intensive experience in all these branches?" And that answer, modified to fit the position, can be applied to all naval dental activities.

If well versed and capable in the general practice of all branches of dentistry, dental officers not only prepare themselves for these positions of responsibility, but are equipped to give the personnel they serve intelligent and well-balanced advice and efficient dental service.

Analyzing the course of study at the Navy Dental School and comparing it with postgraduate teaching at civilian institutions, it

becomes evident that the period of instruction for each class, which is four and a half months, is an intensive one.

Upon the completion of the courses of study, student dental officers should have acquired a wholesome respect for the interdependence of the various branches of dentistry and should appreciate the importance of proficiency in all of them. Perhaps those who are talented or inclined along the lines of a specialty may have acquired some points of interest and value to them in regard to that specialty and its relation to general practice.

The following is the present curriculum of the Navy Dental School:

Medical Department duties: Lecture, one hour per week.

Oral surgery: Clinical instruction, four hours per week.

Operative dentistry: Clinical instruction, eight hours per week.

Crown, bridge, and ceramics: Clinical instruction, eight hours per week.

Denture construction, full and partial: Clinical instruction, nine hours per week.

Current literature, administration, and special lectures: Weekly conference.

Serology, pathology, bacteriology: Lectures and laboratory work, three and one-half hours per week.

"RHINONEUROSIS"

By C. A. SWANSON, Lieutenant, Medical Corps, United States Navy

"Rhineurosis" designates a functional disease of the nose which, though not associated with any discoverable lesion, constitutes a clinical syndrome, simulating those of various organic diseases of the nose and accessory sinuses. Patients of this class desire diagnoses to explain their symptoms, and the rhinologist sometimes offers a premature diagnosis in order to gain the patient's confidence. Having a diagnosis, although incorrect, the patients desire treatment directed against their ailment.

In the service, because of frequent changes of station, we are called upon to continue treatment in these cases. The patients demand a régime of treatment similar to that carried on by the preceding doctor. The patient's demands are too often granted. Scientific therapy is spared in order to avoid antagonizing the patients. Because of this we have a class of patients demanding nasal packings with various medicaments, principally argyrol and cocaine.

We must be cautious in dismissing these cases as functional when we are confronted by unusual or paradoxical symptoms. We must carefully exclude all organic pathology. Suppurative conditions in

the nose and sinuses are usually easily recognized. There are several distinct clinical entities which cause headache, often referred to as neuralgia of the nose or nonsuppurative nasal headaches. Those especially worthy of mention are:

1. *Vacuum frontal headache*.—This consists of a low-grade continuous headache caused by closure of the frontal sinus. This may result from an encroachment of ethmoid cells upon the infundibulum, a hypertrophied uncinate process, a middle turbinate approximating the lateral nasal wall, or a markedly deflected septum. These anatomic variations, accompanied by hyperplastic mucosal changes, may lead to closure of the nasofrontal duct.

The complaint is dull frontal headache increased by ocular effort. There is marked tenderness on pressure over Ewing's point—the inner end of the eyebrow medial and posterior to the fovea trochlearis.

2. *Sphenopalatine ganglia neurosis*.—The symptoms of this condition may be divided into the sympathetic and neuralgic syndromes. The sympathetic syndrome is manifested by various degrees of rhinitis. The neuralgic syndrome follows, which consists of pain at the root of the nose, in and about the eyes, upper jaw, and teeth and extending backward to the ear, most marked 5 cm. back of the mastoid. Cocainization of the nasal ganglia controls these symptoms and is an indispensable aid in diagnosis.

3. *Hyperplastic postethmoid sphenoiditis*.—This is characterized by a dull recurring occipital headache. When the Vidian nerve is involved by hyperplastic changes of the sphenoid, the nasal ganglion syndrome may be produced. The optic nerve may be involved. The pain is not relieved by sphenopalatine cocainization. On examination there is thickening of the mucosa, which gives it a cloudy appearance rather than the pink silk texture which is normal. Small dilated blood vessels are seen over the sphenoid. The posterior tips of the midturbinate are hyperplastic and polypi may be seen.

4. *Nasociliary neuralgia*.—First described by Sluder in 1922. This causes pain in an area bordered by the superciliary ridge above, the supra-orbital notch laterally, and nasal bones below. Patients wearing glasses complain of the pressure caused by the bridge at the root of the nose. As the nasociliary nerve enters the anterior ethmoidal foramen into the nose, it is submucosal in location and in a vulnerable position for irritation. Cocainization relieves pain at the angle formed by the cribriform plate above and the anterior limit of the nasal fossa.

Finding no evidence of the aforementioned entities or other obvious organic disease involving the sinuses and nose, we are still confronted with a class of patients presenting a nasosinus syndrome. Röntgenograms have been made in most of these cases and sub-

stantiate our findings of no organic pathology. The accompanying table, compiled in collaboration with Dr. E. C. Ebert, shows the frequency of these patients in the various age groups and the length of time they have received nasal treatment.

Age group—Duration	Male	Female	Age group—Duration	Male	Female
25-30:			45-50:		
Less than 1 year...	4	0	Less than 1 year...	6	6
1 year.....	0	0	1 year.....	7	6
18 months.....	1	0	18 months.....	6	2
30-35:			50-55:		
Less than 1 year...	2	0	Less than 1 year...	7	6
1 year.....	6	4	1 year.....	5	5
18 months.....	2	1	18 months.....	2	0
35-40:			55-60:		
Less than 1 year...	7	5	Less than 1 year...	4	2
1 year.....	5	1	1 year.....	3	3
18 months.....	2	1	18 months.....	1	0
40-45:			Total.....	77	53
Less than 1 year...	1	6			
1 year.....	4	5			
18 months.....	2	0			

In this series of cases we are not dealing with a neurosis affecting the olfactory sense. These patients have vague nasosinus complaints. The almost invariable chief complaint is "sinusitis." Further questioning reveals they have a "heaviness of the head" and at times a dull generalized headache. The headaches occur at no specified time and bear no relation to ocular effort. They all complain about a discharge from the nose and a disturbed nasal aeration. There is no seasonal variation as to the frequency of desired treatments, although inclement weather makes the complaints more marked. At home these patients constantly use various brands of nasal sprays. Nasal packings with ephedrine, cocaine, or adrenalin give immediate relief. Shrinkage of the nasal mucosa is interpreted by them as a normal feeling. These patients are in no way gravely concerned with their sinusitis. Some patients give the impression of cherishing this malady. They relish this illness as some patients relish their operations.

A past history shows that at some time in the past when they had a cold they were informed they had a "sinus condition." Many times they say their attending physician told them they had a "slight sinus condition" and referred them to a rhinologist. It seems that nasal packings were used empirically and continued to be used without definite reason. Encountering these patients for the first time, they demand nasal packs. No definite reason is offered why. They have had them in the past and want them now.

It is quite obvious that the ills of these patients have been induced through suggestion. Many may have had an actual sinusitis or

rhinitis, but, as we all know, these conditions are usually self-limited diseases. They have been led to believe any nasal secretion is abnormal.

A number of our patients insist on having cocaine packs in the nose. It has been stated that patients receiving this treatment do not become addicted to cocaine.

Let us, however, review briefly the pharmacology of this drug. In most cases small quantities produce pleasurable excitement. The patient is more restless and garrulous than in ordinary life. In other cases small doses produce a languorous state, resembling that induced by morphine, but differing from it in there being less tendency to sleep. The natives of Peru and Bolivia have used this drug to increase their endurance to fatigue. Physiologists assert that more physical work can be done after small doses of cocaine than before it. It therefore seems reasonable to me that a feeling of well-being can be had from nasal packings with this drug. Many addicts use cocaine by snuffing it. I do not know of a case of cocaine addiction from nasal packing with this drug, but I do feel we have patients who desire cocaine nasal packs because of the euphoric feeling it produces. I believe this is why some of our patients insist on this drug and say it is the only thing that gives complete nasal relief. May we refer to these cases as potential cocaine addicts? In our dispensary practice we have practically eliminated the use of cocaine as a therapeutic agent.

We may speculate, however, as to other possible factors in at least some of these cases. Distributed over the inferior turbinates and posterior tip of the middle turbinate and over adjacent parts of the nasal septum is an erectile tissue similar to that found in the genitalia. This erectile tissue is under control of sympathetic fibers from the sphenopalatine ganglia. There is thus an anatomic pathway to the sympathetics which control the sexual functions.

Clinically we may also demonstrate a close nasosexual relation. Canfield (quoted by Stinson) (1) cites a case of a young woman where massage of the turbinates produced a definite orgasm. Schiff (quoted by Posey and Wright) (2) by cocainizing the genital spots of the nose relieved the pain in 24 of 47 cases of dysmenorrhea thus treated. Mental suggestion was carefully avoided in these cases. Enlargement of the erectile tissue occurs during menstruation, producing headache and at times vicarious menstruation. Engorgement of the erectile tissue also occurs during sexual excitement, similar to that occurring in the nipples. This may lead to simple nasal obstruction. Cases of ozena are aggravated during the menses. Reflex pain referred to the sinuses occur in pelvic displacements. Stinson (1) cites a case of a pregnant woman with a typical frontal sinusitis syndrome which persisted through two separate pregnancies

and a normal condition in the interim. No sinus pathology could be demonstrated. I shall cite a case of Dr. C. D. Blassingame (quoted by Stinson) (1):

A young woman who came in occasionally to have her nasal mucous membrane shrunk because of nasal discomfort volunteered the information that these attacks followed nights of sexual debauchery.

Much of the latter part of this paper may appear fanciful, but it touches on a phase of the subject which can scarcely be ignored.

CONCLUSIONS

1. The majority of these patients can be cured by psychotherapy. A gradual weaning from nasal packs and repeated suggestion that the nose and sinuses are well will give complete recovery.
2. Cases of rhinoneurosis may possibly follow sexual debauchery.
3. Gynecological disorder may produce a rhinoneurotic syndrome.
4. Physicians should be extremely careful in suggesting a diagnosis to patients for complaints unless supported by definite clinical data.
5. Indiscriminate use of nasal packings should be condemned.

REFERENCES

1. Stinson, W. D.: Naso Sexual Relations. J. Tenn. M. A. 22:173, September, 1929.
2. Posey and Wright: Diseases of Eye, Nose, and Throat. 1902.
3. Jackson and Coates: The Nose, Throat, and Ear and Their Diseases. 1929.
4. Cushny: Pharmacology of Drugs. Ninth edition, 1928.

SPECIAL SECTION

SPLINT MANUAL, UNITED STATES NAVY

ILLUSTRATING USES OF A MINIMUM EQUIPMENT IN THE TREATMENT OF FRACTURES ASHORE AND AFLOAT

By G. F. COTTLE, Commander, Medical Corps, United States Navy

FOREWORD

During the war, in 1917, a board of medical officers of the Army, including reserve officers of the Army well known in civil life for their ability in bone and joint surgery, reported to the commander in chief of the American Expeditionary Forces upon the "advisability of standardizing certain appliances to be used by the Medical Department." The product of this board's deliberation and investigation was an illustrated manual of splints and appliances for the treatment of bones and joint injuries. Printed in Paris by the American Red Cross, this manual was distributed widely to medical officers of the Army and Navy and has since that time stood as the basic work on standardization of splints and other retentive appliances. Since the war the American Medical Association and the American College of Surgeons have continued the work begun in the Army by the appointment of fracture committees. Some of the members of the original Army board have continued to serve on these committees and to work with a group of civilian surgeons interested in fracture treatment. Each year at the American Medical Association's meeting the committee arranged exhibits to demonstrate acceptable methods in the treatment of fractures. In 1930 the American Medical Association printed a book entitled "Primer on Fractures,"¹ based upon the propaganda found in the exhibits each year. In the pages of this primer appear diagrammatic sketches and brief paragraphs of description of acceptable methods of treatment. A minimum fracture equipment for the doctor's automobile and a minimum fracture equipment for the doctor's office are illustrated. A study of the pages of this book should help all physicians to visualize more clearly the essentials

¹ Primer on Fractures, Illustrated, 1930. A. M. A., 535 North Dearborn Street, Chicago, Ill. \$1.

of present-day fracture treatment and to remind them especially of the importance of the first aid to be administered by the physician first in contact with the patient. The slogan, "Splint 'em where they lie, transport to an X-ray machine and a surgeon especially interested in fracture cases," is stressed throughout the primer.

The American College of Surgeons, as part of its program for standardization of hospitals throughout the United States, has recommended certain minimum standards considered to be requisite for a hospital entitled to a class A designation. From the 1930 bulletin on hospital standardization there is quoted the following paragraph, headed "Treatment of Fractures":

The American College of Surgeons, through its committee on the treatment of fractures, has done a great deal in the past three or four years to improve the care of fractures in hospitals. * * *

* * * A minimum standard for the transportation and emergency treatment of fractures was established. The standard is as follows:

(a) That all general hospitals be equipped to care for fractures; that the minimum equipment for the transportation and emergency treatment of fractures be the following, or its equivalent:

Thomas upper-extremity splints; Thomas lower-extremity splints with traction straps, slings, and buckle straps; Hodgen splints; coaptation splints, assorted sizes; Cabot wire splints; straight pieces of wood (of assorted length, width, and thickness) for splints; plaster-of-Paris bandages; some form of overhead frame for suspension; suitable X-ray apparatus, including a portable machine, if practicable.

(b) That it is highly desirable that one individual surgeon be responsible for the supervision of the care of fractures in each hospital service.

(c) That special record sheets be used for fracture cases.

(d) That a close follow-up be maintained on all fracture cases for such time as necessary to establish an accurate knowledge of end results.

The attention of hospitals is particularly directed to the necessity of arranging a proper splint room in a convenient location. A portable X ray is always of great advantage for the more efficient and safe treatment of fracture cases. Many observations can be made at the bedside without moving the patient, which frequently may be impossible and difficult. Hospitals are urged to have a member of the staff interested in this work supervise all fracture cases in the hospital, working, of course, when necessary, with the doctor in charge of the patient. * * *

It is recommended that all cases of fracture in the hospital come under review at the regular staff conference, when diagnosis, treatment, and progress should be considered with the necessary demonstration of X-ray pictures accompanying the discussions. In this way the efficiency of the treatment of fractures will be increased and the medical profession gain first-hand information regarding this important phase of work. * * * Treatment of fracture patients can not be regarded as complete simply because the patient is able to leave the hospital. It is a long-drawn out process, involving often both mental and physical rehabilitation, and it is the duty of the hospital to aid in securing readjustment in every way possible.

The March bulletin of the American College of Surgeons contains an article written by its fracture committee, entitled "The Principles and Outline of Fracture Treatment."²

The form for recording a fracture case recommended by the American College of Surgeons appears as Figure 1 in this manual.

The naval surgeon may by requisition on the supply depot have at hand at least one standard up-to-date treatise on fractures. Every year a suitable book on this subject is purchased and supplied to medical units which request a book on fractures. In naval hospitals and other large medical groups more than one standard textbook on fracture is to be found in the library.

Conditions in the Navy are somewhat different from those existing among civilian physicians in the United States and somewhat different from those in the Army. The naval surgeon can not always limit his care of a fracture to transportation and the administration of first aid. Appliances for the treatment of fractures should be available, and for this reason a minimum standard equipment obtainable by requisition on the Naval Supply Depot would seem to be a necessity. The following list has been suggested:

FRACTURE EQUIPMENT, MINIMUM

Bandages, cotton, elastic.
Bandages, gauze.
Bandages, plaster-of-Paris.
Binder board.
* Crinoline, suitable for making plaster bandages.
Pins, safety, large.
Plaster, adhesive.
* Plaster of Paris, suitable for making plaster bandages.
Muslin, bolts.
* Splint manual, diagrams and sketches of use of minimum equipment.
Splint, basswood for.
Splint, wire mesh for.
Splint, arm, Thomas.
Splint, leg, Thomas.
* Splint, leg, Pierson, attachment for Thomas.
* Tractor, skeletal, ice tong, Adams.
* Tractor, skeletal, Steinman, pin set.
Pulleys, awning block, 1-inch, single.
Rope, cotton, 18-thread, 6-ply, ½-inch circumference.
Sheets of felt.

The last three mentioned items appear in the Federal Standard Stock Catalogue upon which the Navy draws its supplies and are frequently in stock aboard ship.

NOTE—Items marked with an asterisk (*), although not now on the supply table, have been recommended for insertion on the supply table.

² Bulletin of the American College of Surgeons, Vol. XV, No. 1, March, 1931. This bulletin, as well as a reprint of this article, may be obtained by requisition on Naval Medical Supply Depot.

To illustrate the scope and variety of treatment which this minimum equipment permits, this pamphlet, entitled "Splint Manual, U. S. Navy," has been prepared. With the exception of the Jones humerus ambulant splint shown in one of the illustrations (fig. 23), all the treatments indicated and many others are possible if this minimum equipment is available and the naval surgeon utilizes the carpenter and the machinist in the command where he is serving.

It is fully realized that no restriction should be placed upon individual ingenuity in solving the many mechanical problems of fracture treatment. The naval surgeon in a well-equipped and fully staffed hospital should not be limited to this minimum equipment. He can procure within reasonable limits any apparatus or equipment needed by special requisition. The naval surgeon in the field with the Marine Corps expeditionary forces or on board a naval vessel is of necessity restricted in fracture apparatus or treatment. It therefore becomes most important for all medical officers to learn the uses of the minimum equipment listed on the naval medical supply table.

If every naval surgeon were to treat fracture cases every day or week, his treatment would become simplified by practice. Not infrequently, however, he will go for months without seeing a fractured bone and then of a sudden find himself confronted by a difficult fracture problem. If possible, he will administer first aid, splint his patient, and transport him to a naval unit where X-ray and special care are obtainable. Frequently the nature of his environment and the military mission of his unit will prevent him from sending his patient to a hospital ship or hospital. He may be unable to move him because of lack of proper transportation facilities. He may find it impossible to keep in his supplies even the minimum equipment allowed. He may find it necessary to improvise equipment from limited materials, perhaps with a carpenter and a blacksmith to help him. His experience in a proper method of treatment may be sufficient, but his memory of the details of the specifications of needed apparatus may be too dim to help him to improvise quickly or assemble the various items he needs to use.

The aim of this manual is to illustrate appliances, to refresh the memory of the naval surgeon at the moment when he is attempting in a difficult or unusual environment to apply his knowledge of fracture treatment.

This manual is not offered as the last word in treatment. It makes no pretense to state what method of treatment is best. Its purpose is not to make unnecessary frequent reference to books, monographs, and articles on fractures. It is simply an attempt to outline the major mechanical aids and methods in common use to-day

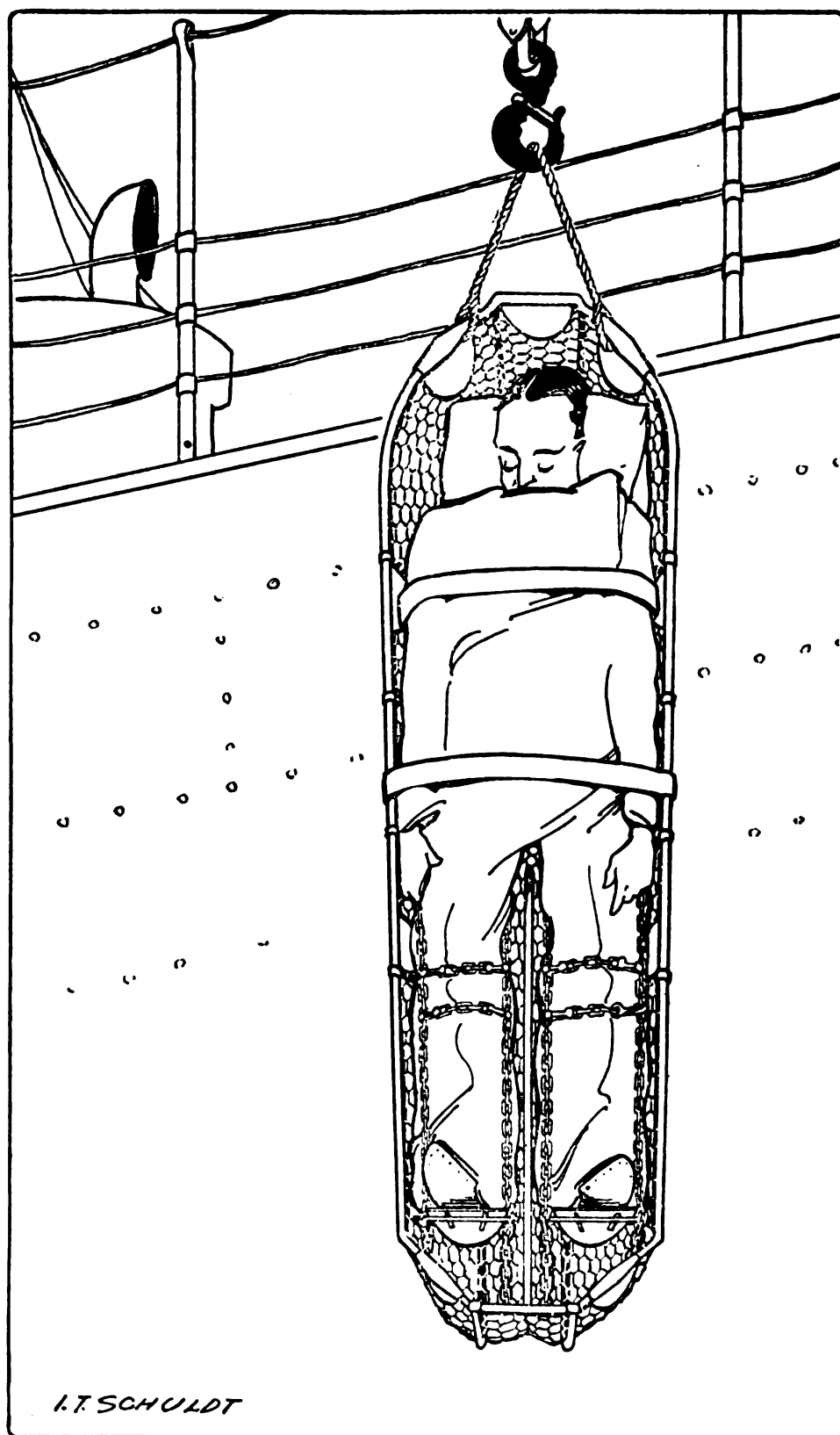


FIGURE 2.—The Navy stretcher at sea

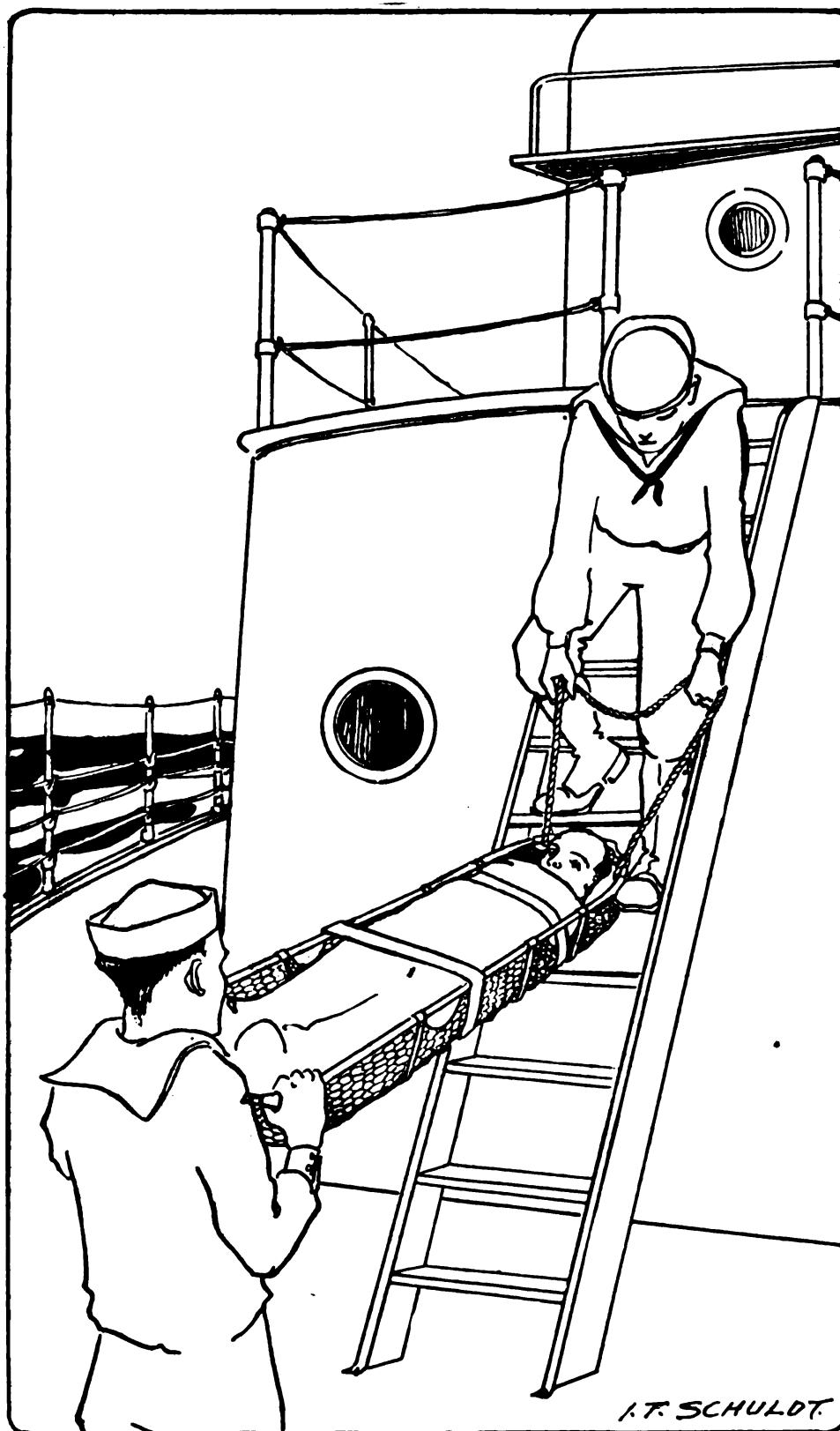


FIGURE 3.—The Navy stretcher at sea



FIGURE 4.—The Navy stretcher at sea

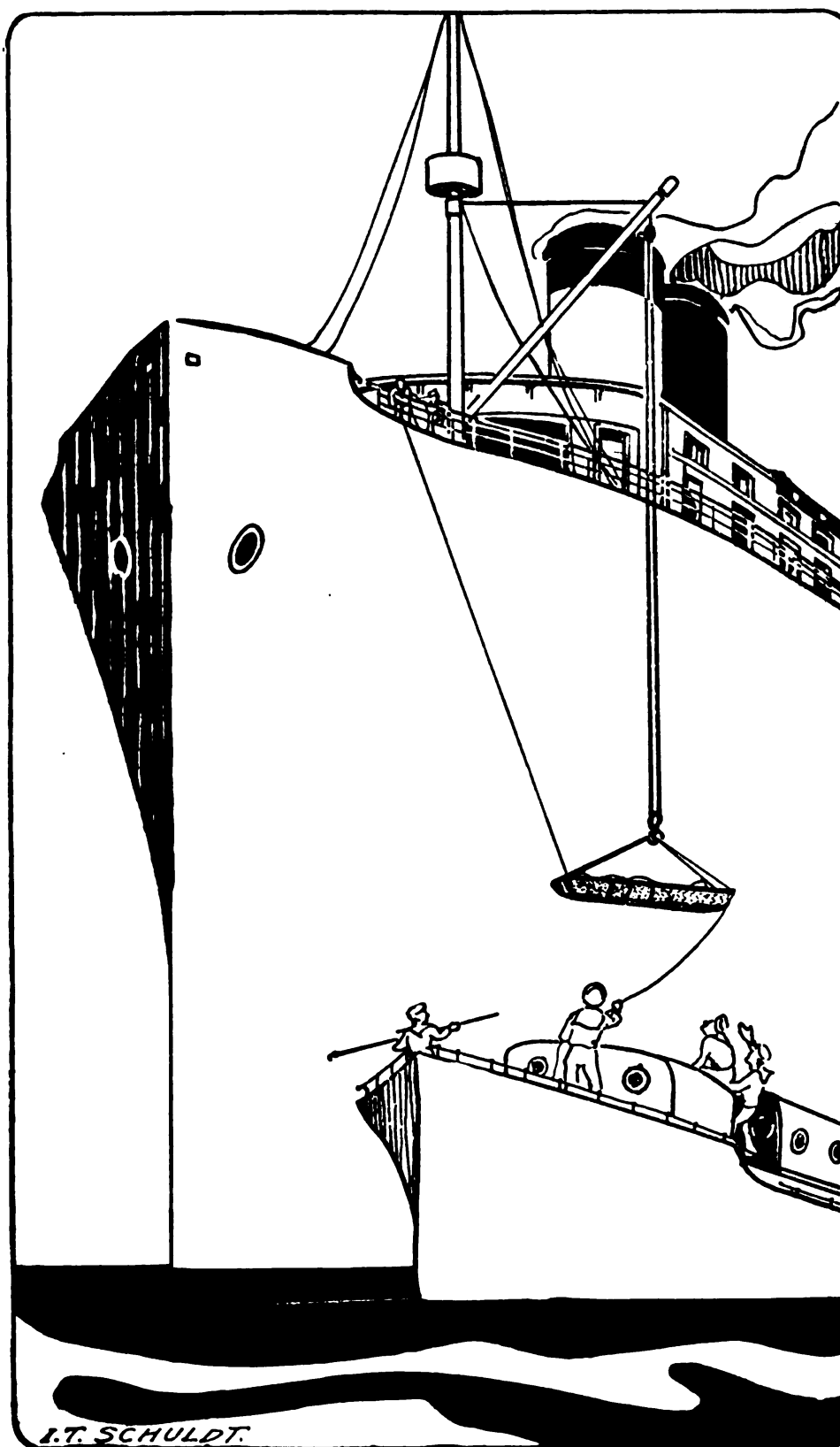
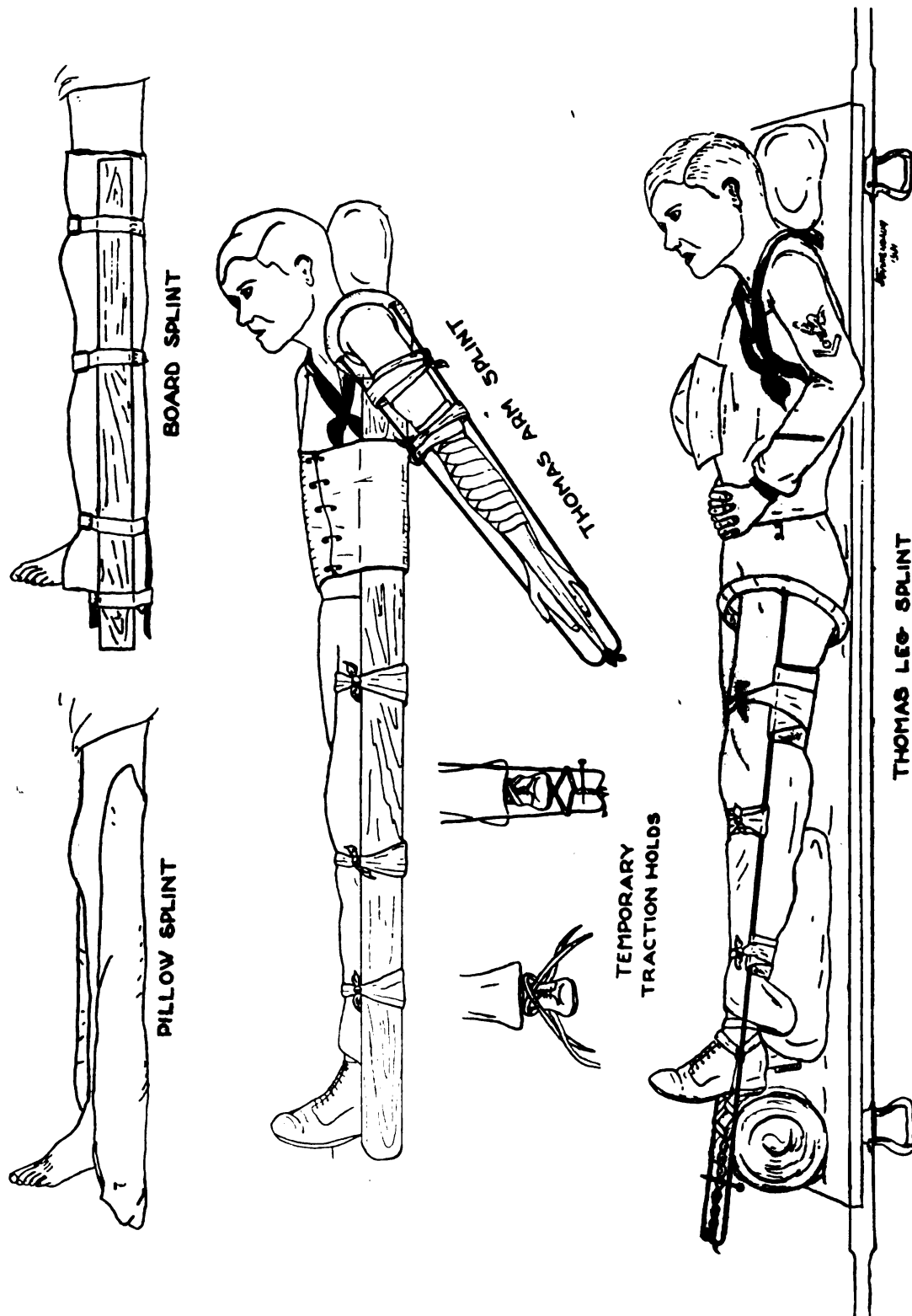


FIGURE 5.—The Navy stretcher at sea



THOMAS LEE SPLINT

FIGURE 6.—Transportation with canvas stretcher



FIGURE 7.—Thomas splint, leg. Extrinsic adhesive traction and susp

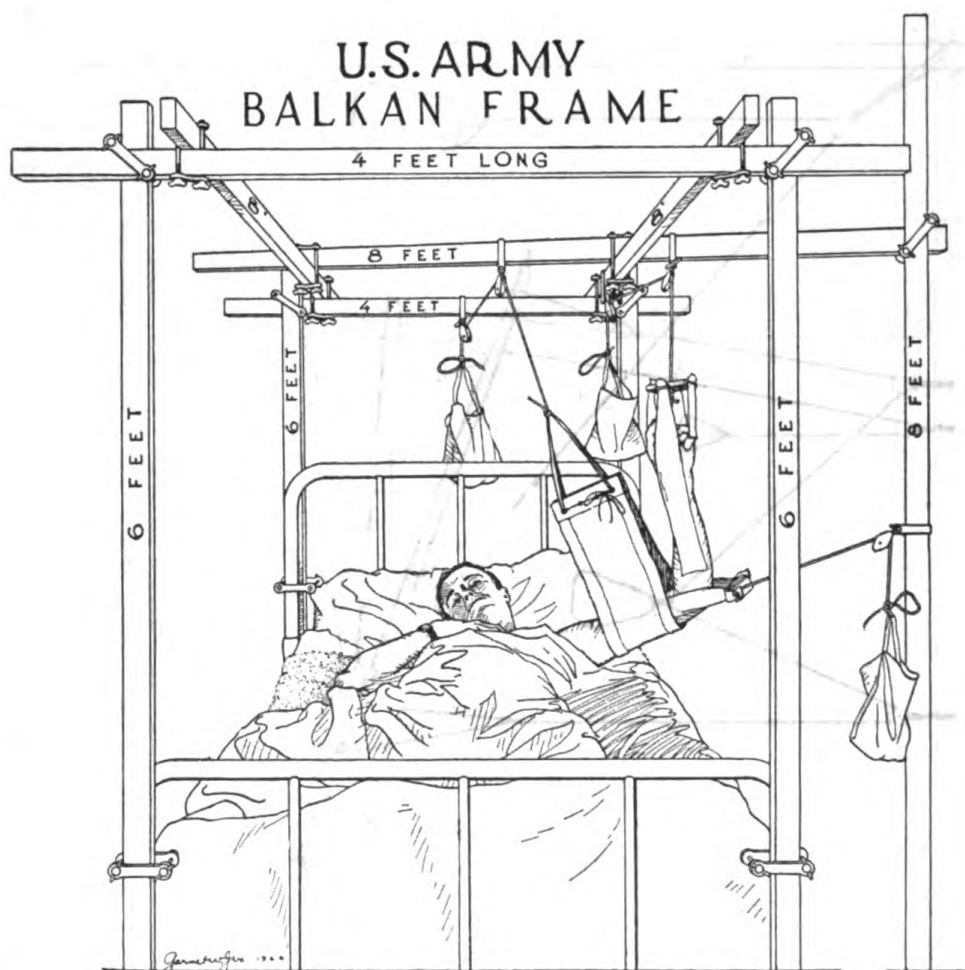


FIGURE 8.—Blake suspension. Extrinsic adhesive traction and suspension in Army frame for fracture of humerus. (Permission of Surgeon General's Office, U. S. Army)

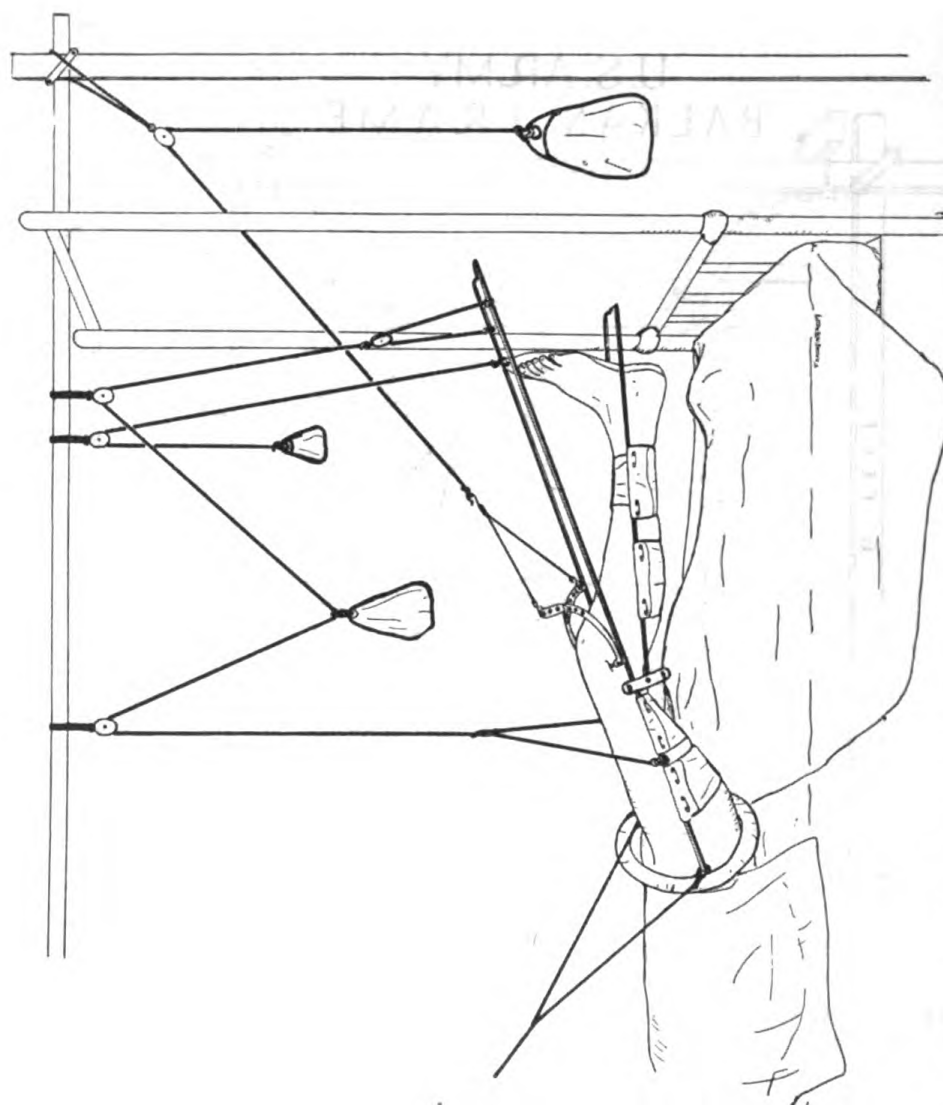


FIGURE 9.—Thomas splint, leg. Extrinsic "ice-tong" or Steinman pin skeletal traction in suspension with Pierson attachment for fracture of shaft of femur

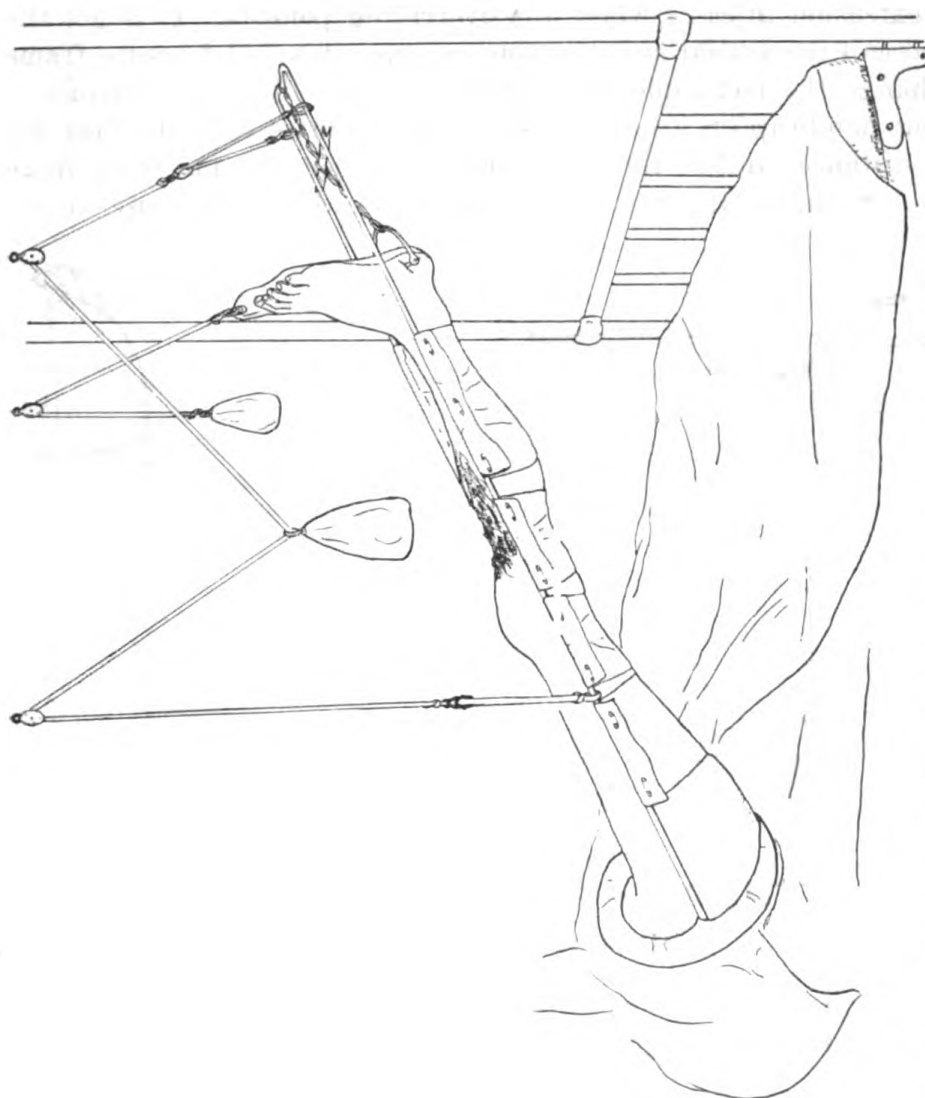


FIGURE 10.—Thomas splint, leg. Intrinsic skeletal Steelman pin. Traction and suspension for fracture of the tibia and fibula

SUSPENSION TRACTION AT SEA^{*}

It is in fractures of the femur, humerus, tibia, and fibula, and sometimes the radius and ulna when traction and extension become necessary, that conservative methods present serious handicaps at sea. Continuous traction by means of weight and pulley has been recognized as the most effective method for securing constant corrective extension in cases where the overriding persists. It is not the purpose of the antijar swing extension apparatus and fracture frame to change the technique of treating fractures, but to overcome a serious handicap on a hospital ship that operates with the fleet for long distances and at times in stormy weather and far from shore bases. Such an apparatus to be suitably adapted for use at sea

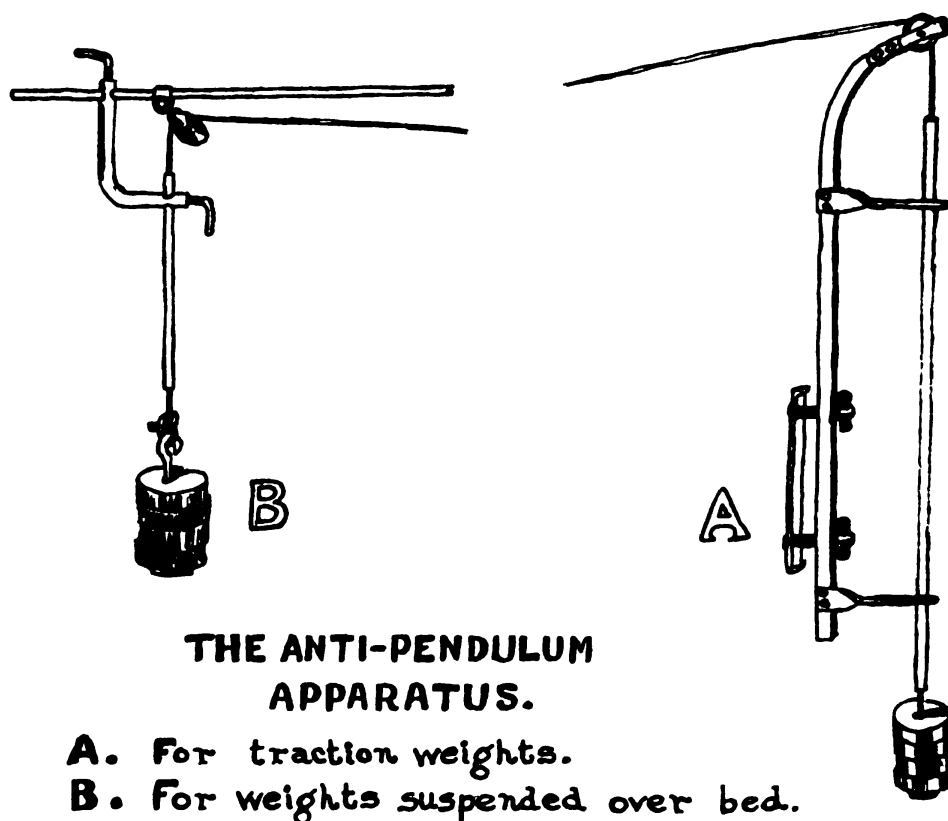
**THE ANTI-PENDULUM
APPARATUS.****A. For traction weights.****B. For weights suspended over bed.**

FIGURE 11.—The antipendulum apparatus

^{*}The material for this section is taken from the article by Lieut. C. M. Shaar (M. C.), U. S. Navy, in October, 1930, NAVAL MEDICAL BULLETIN.

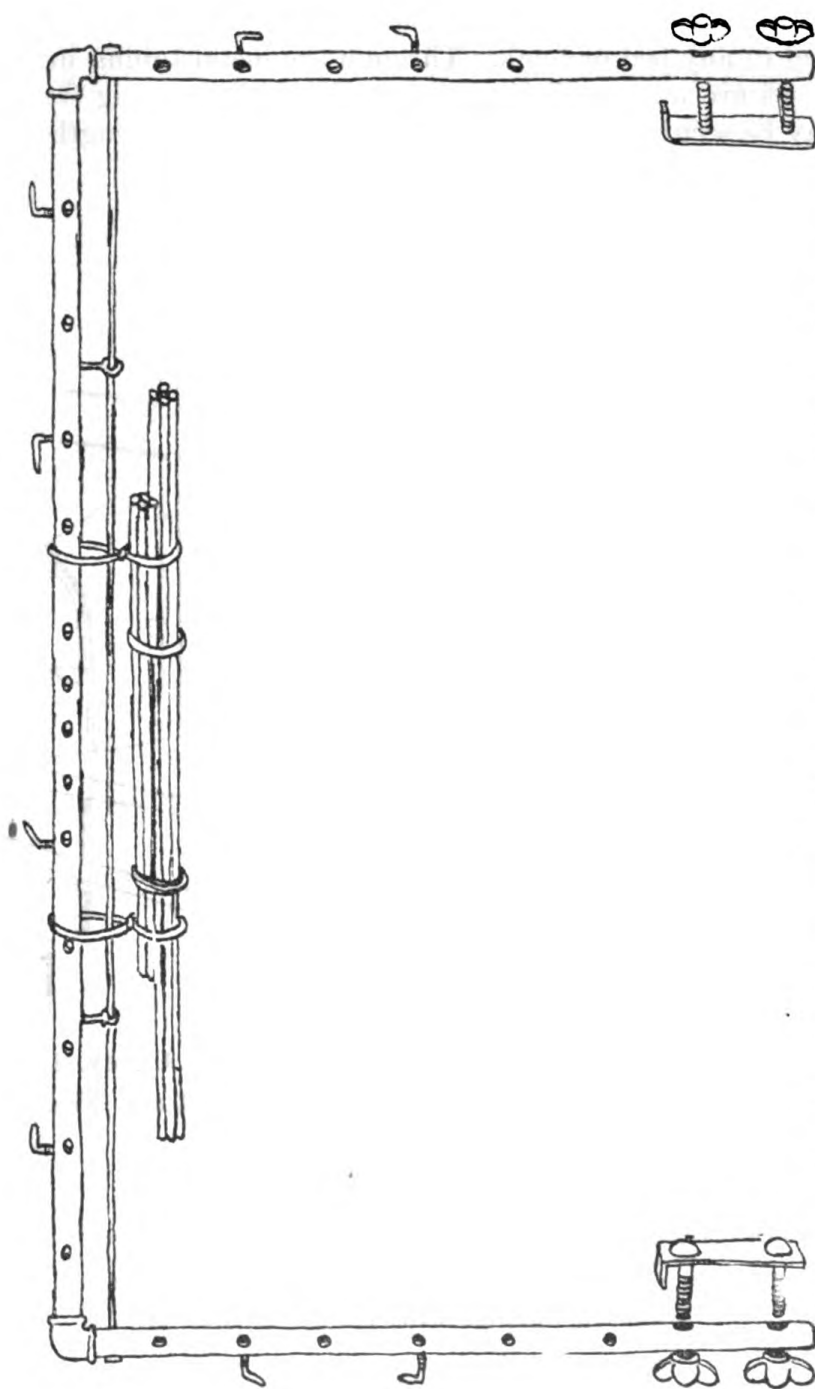
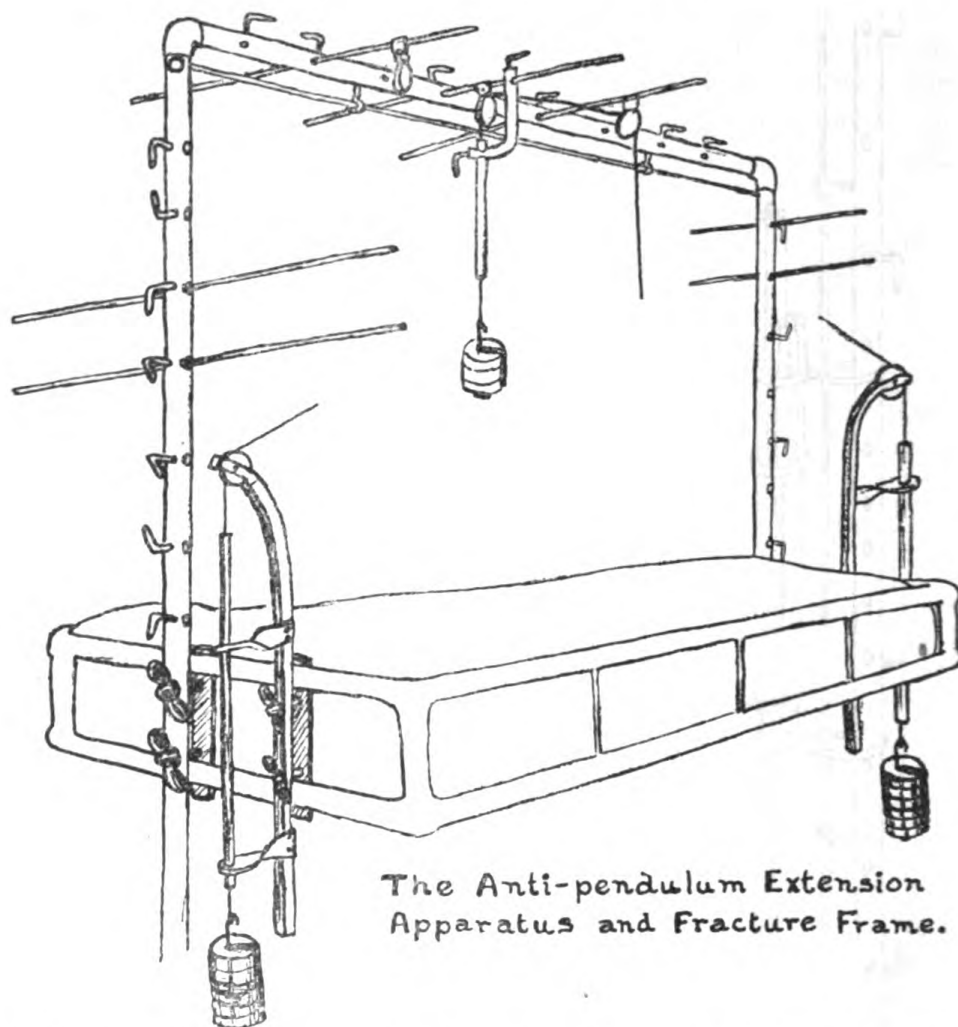


FIGURE 12.—The antipendulum extension apparatus and fracture frame requires small space for storage, is easily and quickly assembled, and may be clamped to any bed or bunk. The clamps shown in this figure are for use on bunk in sick bay

should be antijar swing, compact, durable, simple in construction, inexpensive, and easily adjustable to meet any requirement.

The fracture frame (shown in illustration, and made aboard ship) is made of metal tubing, either of iron or brass (fig. 12), which may be clamped to any bed or bunk. Through the metal tubing multiple fenestrations are made sufficiently large to admit a strong steel rod which may be secured by a thumbscrew at any desired length. The



The Anti-pendulum Extension Apparatus and Fracture Frame.

FIGURE 13.—The antipendulum extension apparatus and fracture frame when assembled and secured to a bunk in the sick bay

fenestrations are made in various directions, so that any angle may be obtained. To the metal rod a pulley with a swivel is clamped at the required distance.

The antijar swing apparatus is an essential feature of the frame. Two types are required, one for the traction weights and the other for weights suspended over the bed. The apparatus for traction consists of a square rod, the upper end of which is curved to receive a

pulley. A suitable clamp is applied to its shaft, by means of which it can be secured to a bedstead or bunk. Immediately underneath the pulley is a small piece of metal tubing, which is attached to the main rod by two small connecting rods. It is so constructed that the traction cord upon leaving the pulley can be passed down through the metal tube in a perfectly straight line. The weight is attached to the cord immediately after it emerges from the tube.

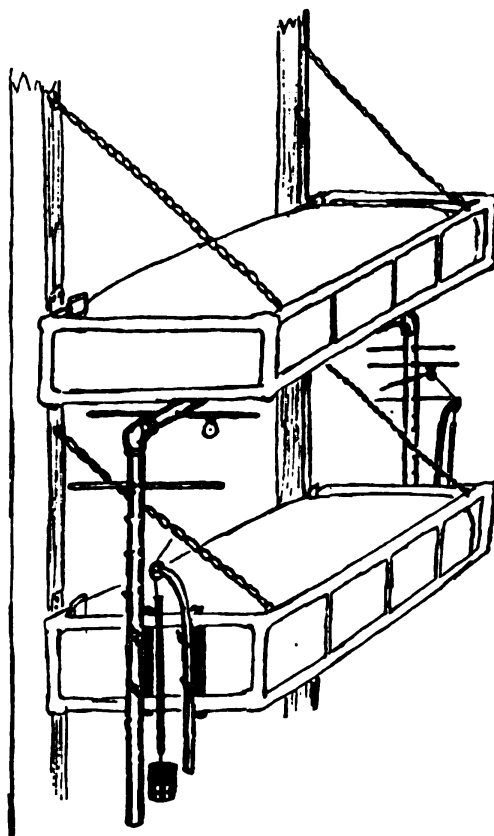


FIGURE 14.—The antipendulum extension apparatus and fracture frame, illustrating its use when double bunks are used. The clamp is constructed in such a way that the frame may be elevated or lowered to any desired height

The purpose of the tube is to keep the traction cord in a straight line and to prevent the weight from being set in pendulum motion by the rolling and pitching of the ship at sea. A similar apparatus is secured to the other end of the bed for a counterextension weight. The ant swing apparatus used for weights suspended over the patient's bed consists of an L-shaped metal rod, with a fenestration through each end, one to secure the rod to the frame under a pulley

and the other for the purpose of receiving a tube of any desired length, which is secured by means of a thumbscrew.

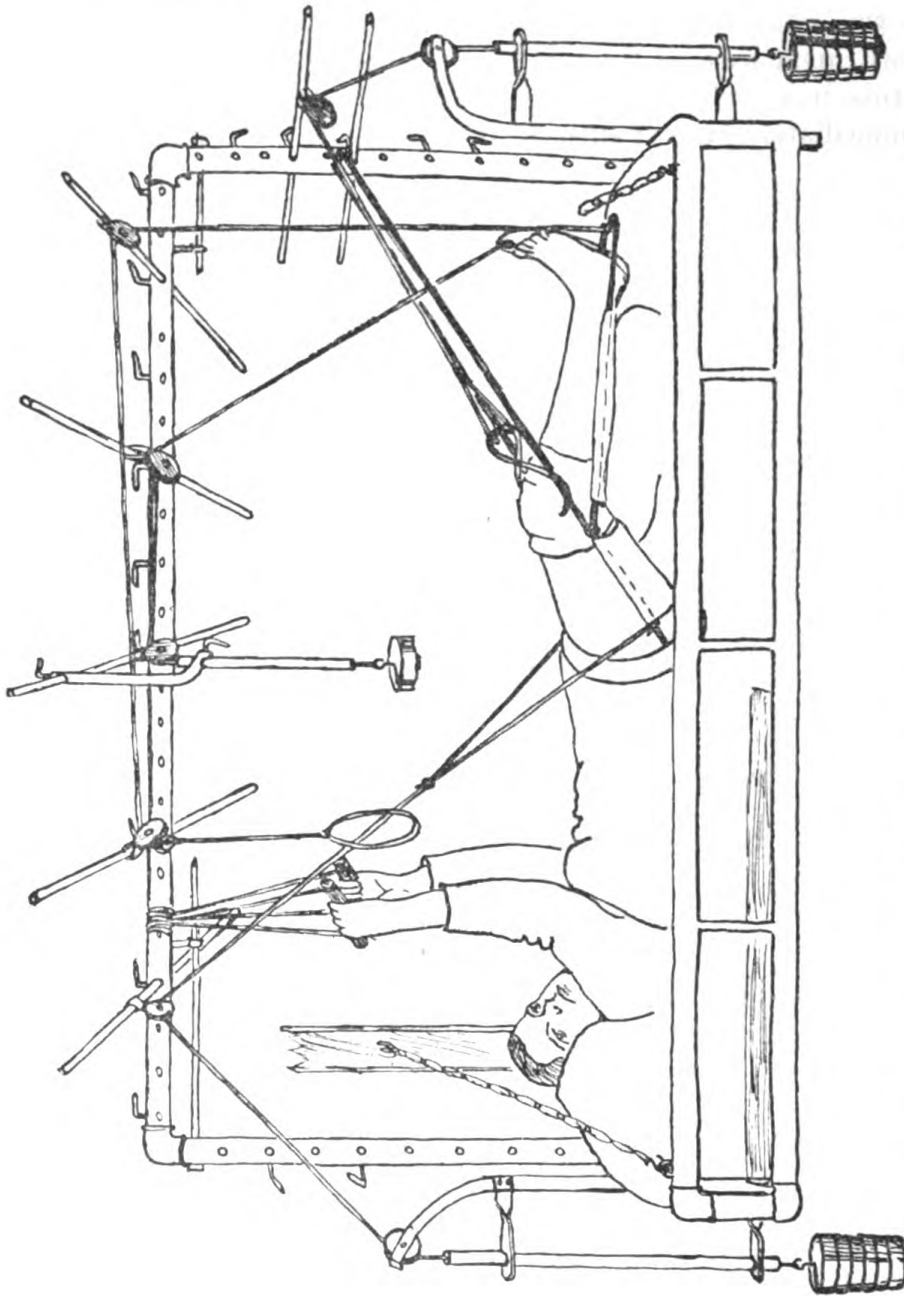
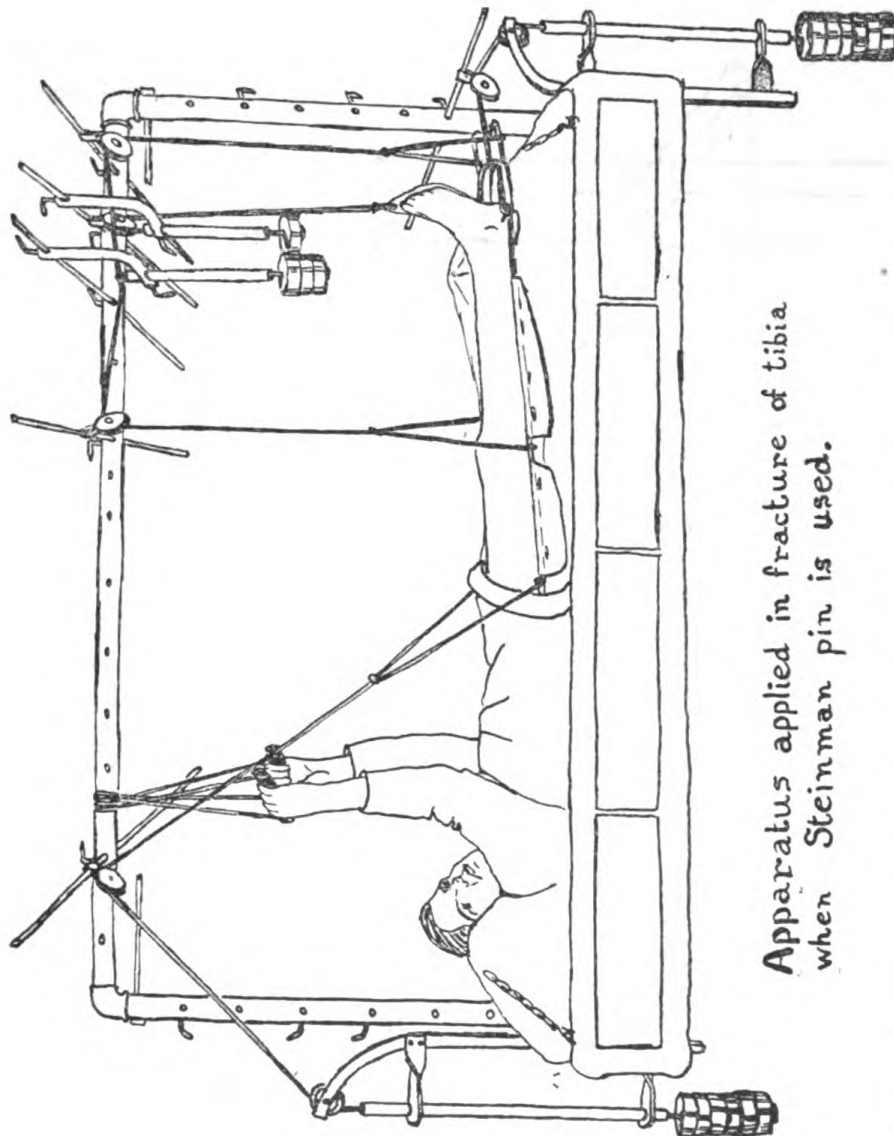


FIGURE 15.—The antipendulum extension apparatus and fracture frame, illustrating the method of applying and suspending the Thomas traction leg splint with hinged knee attachment in skeletal traction by means of "ice tongs" in fracture of the femur



Apparatus applied in fracture of tibia
when Steinman pin is used.

FIGURE 16.—The antipendulum extension apparatus and fracture frame, illustrating the method of applying skeletal traction on the os calcis by means of a Steinman pin

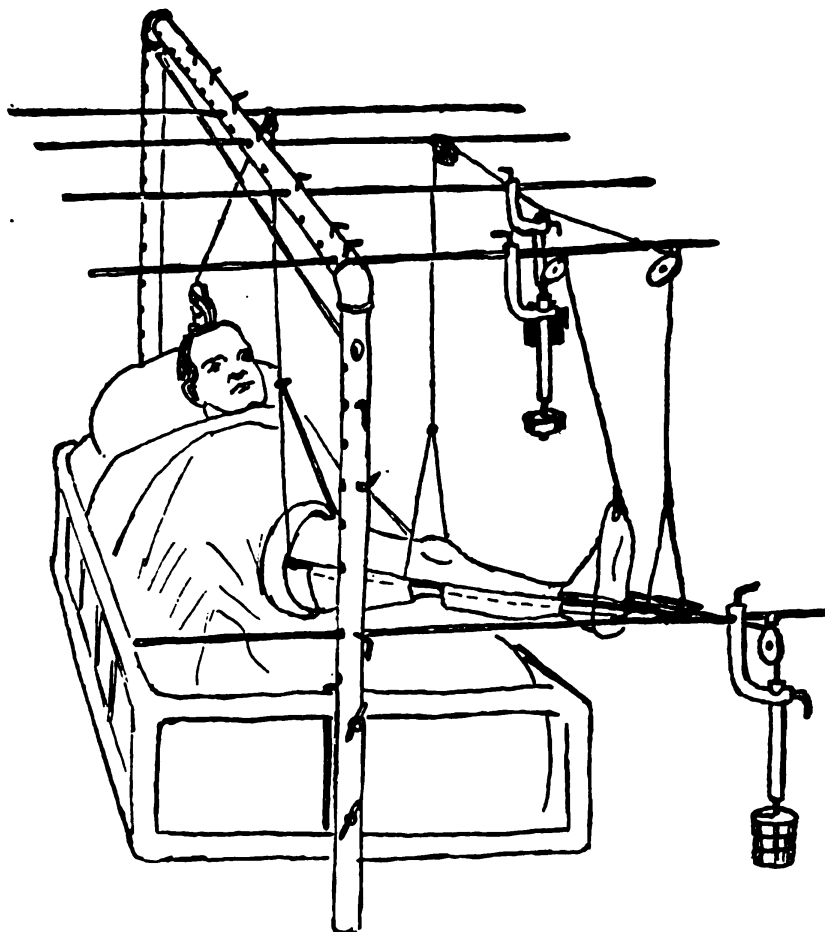
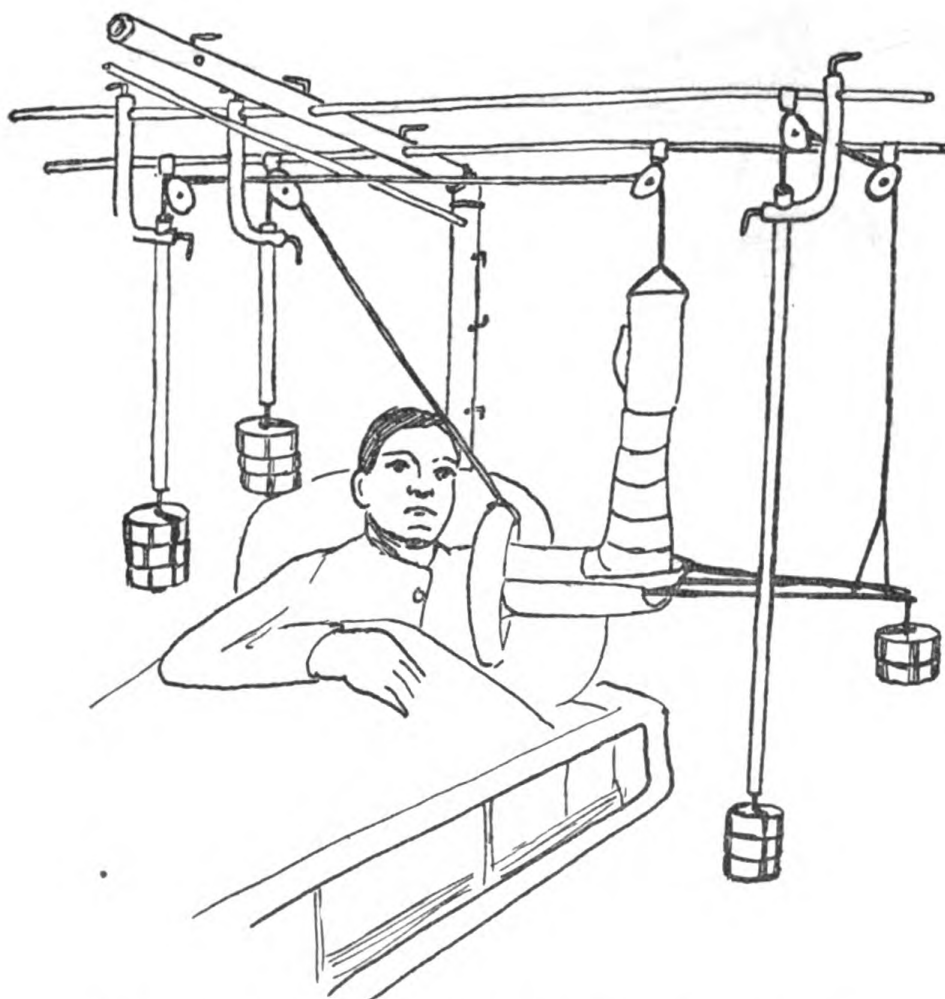


FIGURE 17.—The antipendulum extension apparatus and fracture frame, illustrating the method of applying and suspending the Thomas traction leg splint with thigh in abduction



**How patient is treated in fracture
of humerus with Thomas traction
arm splint.**

FIGURE 18.—The antipendulum extension apparatus and fracture frame, illustrating the method of applying and suspending the Thomas traction arm splint in fracture of the humerus



FIGURE 19.—The antipendulum extension apparatus and fracture frame, illustrating the method of applying traction to the head in fractures and dislocations of the cervical vertebrae

THE USE OF PLASTER

Plaster splints may be used on any part of the body. They may be used as the primary treatment in fractures where there is little or no displacement of fragments or may be used later in the treatment after union has begun in a corrected position which has been gained by extension. There are two general classes:

Plaster encasements, often called circular casts.

Molded plaster splints.

Plaster encasements are usually applied over the padded skin. The padding is necessary to prevent injury when the cast is cut for removal. If applied to a fresh fracture they should be bivalved at once to allow for swelling and prevent ischemic paralysis.

The molded splints of plaster are particularly adaptable to the extremities. They are applied directly to the skin, no padding being used, and are carefully molded to the contour of the part. They are easily removed for physiotherapeutic treatment and always fit when replaced, as they are made for each individual part, and there is no padding to be lost or displaced on removal. If accurately molded when first applied they are extremely comfortable, as there are no points of undue pressure; the pressure is the same at all places and is dependent only on the tightness of the retaining bandages or straps.

The following illustrations show some of the plaster splints most commonly used. The individual doctor's ingenuity will devise other uses and splints as the need arises.

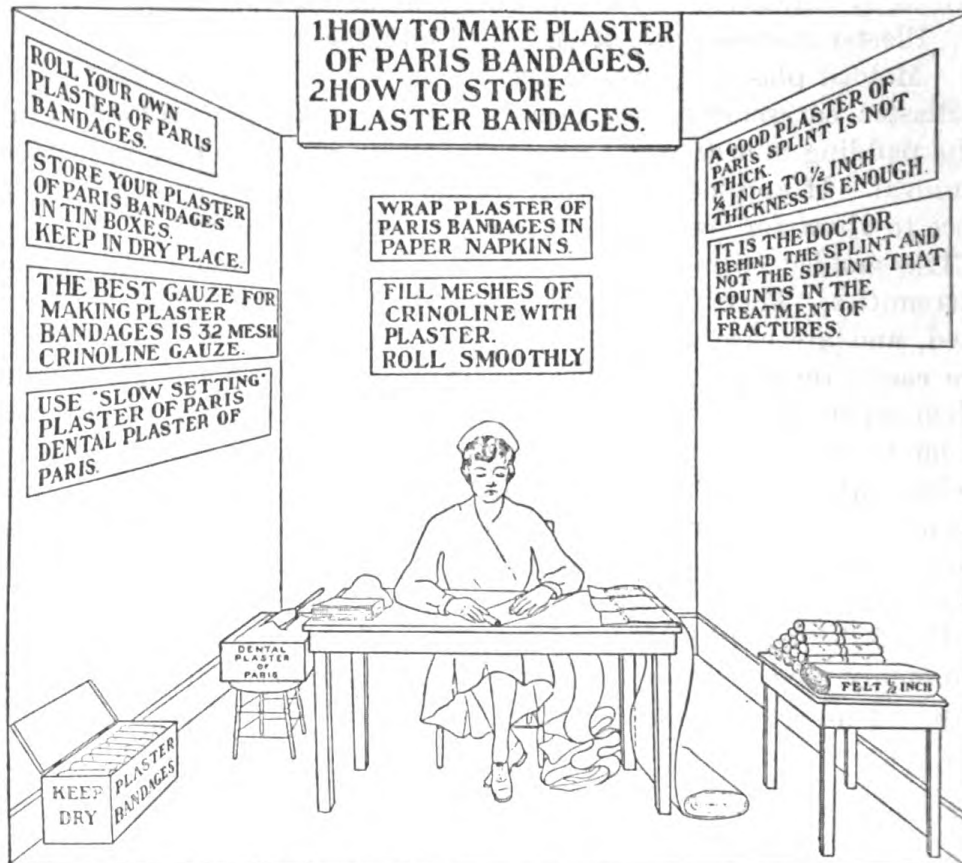


FIGURE 20.—How to make plaster-of-Paris bandages

Office and hospital homemade plaster-of-Paris bandages are cheapest and best.

Buy 32-mesh crinoline gauze, tear it into 5-yard lengths, 2, 4, and 6 inches wide. Pull out three or more threads from each edge of the crinoline. Lay it on a table, fill meshes with plaster-of-Paris of slow or average setting time. Roll up the bandage by hand evenly and not too tightly.

At least one week's advance supply should be made. Wrap the plaster bandages in paper napkins, folding the ends over and holding with a rubber band. Pack them in any dry receptacle, as, for instance, a tin bread box, with a snugly fitting lid. Plaster bandages thus made and packed will keep fit for use for many weeks. (From the Illustrated Primer on Fractures (first edition), published by the American Medical Association and prepared by the Cooperative Committee on Fracture of the American Medical Association, 1930.)

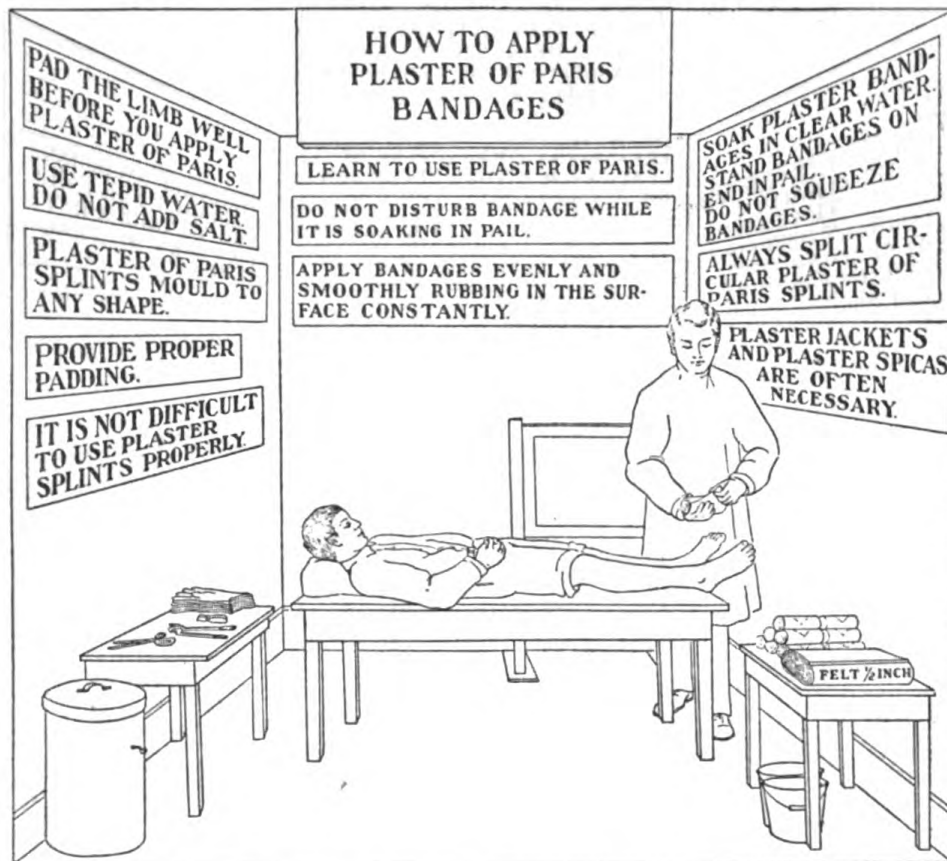


FIGURE 21.—How to apply plaster-of-Paris bandages

Plaster-of-Paris bandages can be made to fit a part of the body of any shape or size.

Learn to use them without disturbing position of bone fragments. After removing the paper napkin cover, place the plaster bandage end up in a pail of tepid water, deep enough to cover it. Do not handle or squeeze soaking bandages. When air bubbles cease to rise from the submerged plaster bandage, it is ready for use. Grasp it in two hands and compress gently to remove excess water but to retain plaster.

Apply the plaster bandage by unrolling around the properly prepared and padded part, or make molded splints of suitable size on a table and bandage on immediately while soft. Apply the plaster bandage evenly without reversing, rubbing the layers smoothly on the surface. Reinforce weak points in circular splints with molded plaster bandages; not with any other material. Do not make the plaster dressing too thick; one-fourth inch is usually sufficient. Split circular plaster-of-Paris splints to allow for swelling. (From the Illustrated Primer on Fractures (first edition), published by the American Medical Association and prepared by the Cooperative Committee on Fractures of the American Medical Association, 1930.)

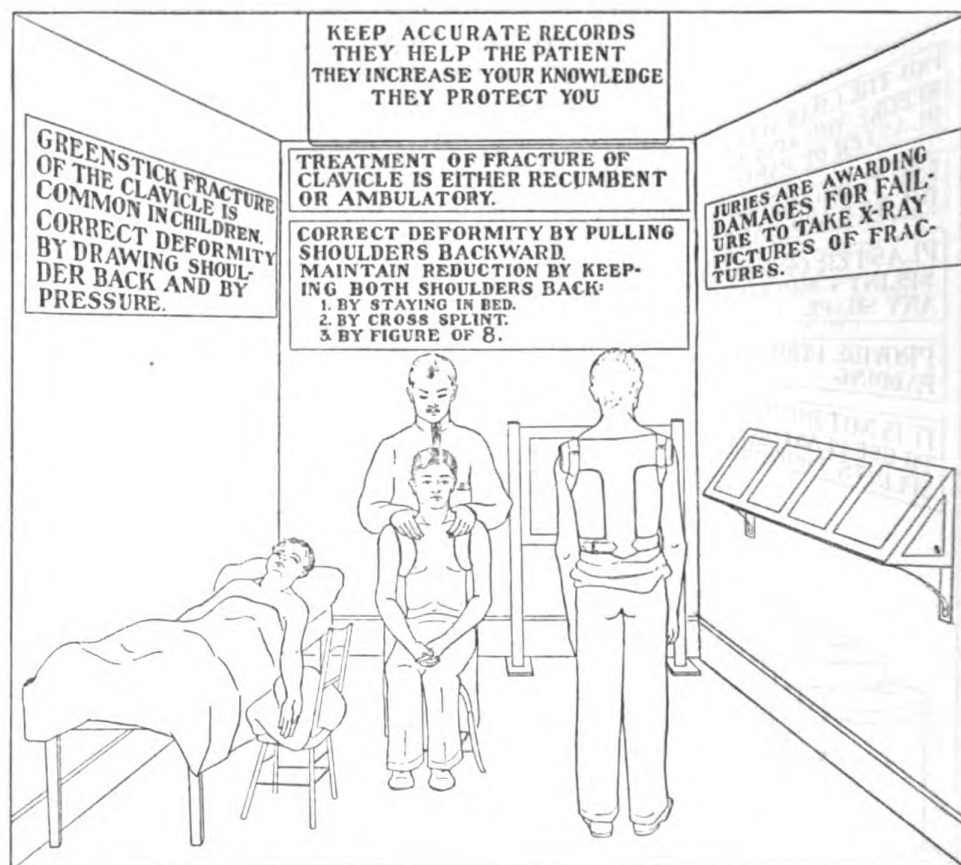


FIGURE 22.—Fracture of the clavicle

The commonest type of fracture is in the middle third of the bone, which allows the shoulder to fall forward, downward, and inward. Palpation of the clavicle will show any overlapping of the fragments. Infants will not use the arm on the injured side and they hold their heads toward the injured shoulder.

Röntgenograms will reveal the fracture and amount of displacement of fragments.

Complete reduction of fragments is difficult, but results after fracture of the clavicle are usually good functionally. The fragments may be best reduced by lying in bed with a pad between the shoulder blades, bringing the injured arm down over the edge of the bed. Next best is the figure-of-eight bandage, holding the shoulder up and back, or the clavicular T-shaped splint. Ambulatory treatment is given by a figure-of-eight bandage, or the clavicular T-shaped splint to hold the shoulders back, to be worn for at least three weeks. During this period, encourage active abduction of the shoulder. (From the Illustrated Primer on Fractures (first edition), published by the American Medical Association and prepared by the Cooperative Committee on Fractures of the American Medical Association, 1930.)

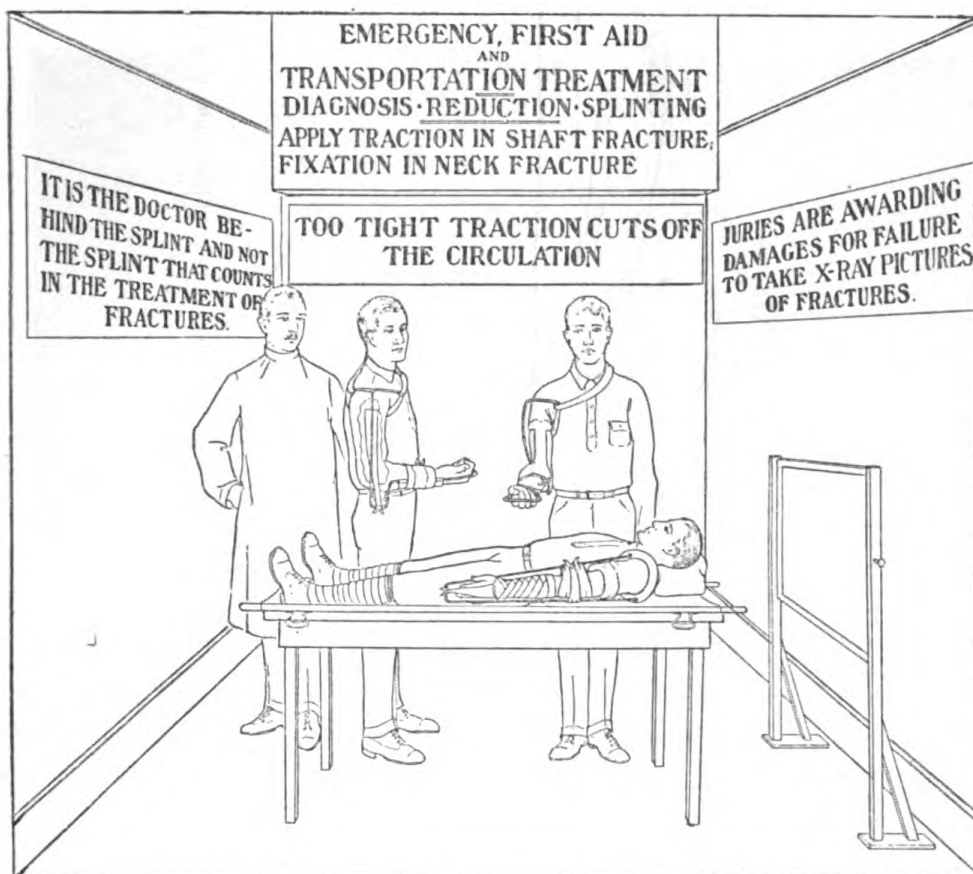


FIGURE 23.—Fracture of the humerus

Emergency and transportation treatment.—First treatment for fracture of the shaft of the humerus requires a mild pull on the arm to steady it and prevent overriding of bone fragments. Rip up the patient's sleeve, apply adhesive tape along the sides of the arm, and fasten the arm in a Thomas arm splint or to any long flat surface. The arm is held in the splint by cross slings or a bandage round all. Do not make the traction too tight or circular; that cuts off circulation in the arm. Intelligent use of simple methods is better than any elaborate splint. Get the patient to the office or hospital for Röntgen examination and permanent treatment. (From the *Illustrated Primer on Fractures* (first edition), by the American Medical Association and prepared by the Cooperative Committee on Fractures of the American Medical Association, 1930.)

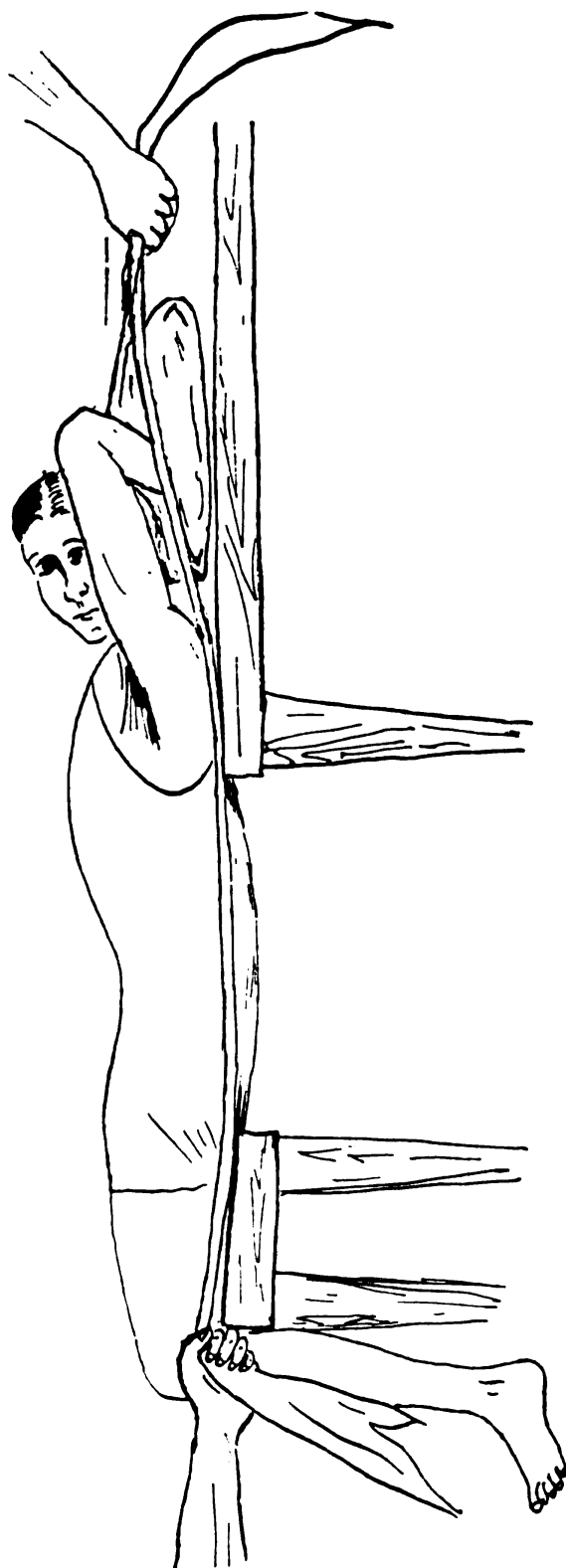


FIGURE 24.—Special tables are a help, but a sheet and two points of support are sufficient for application of a plaster jacket

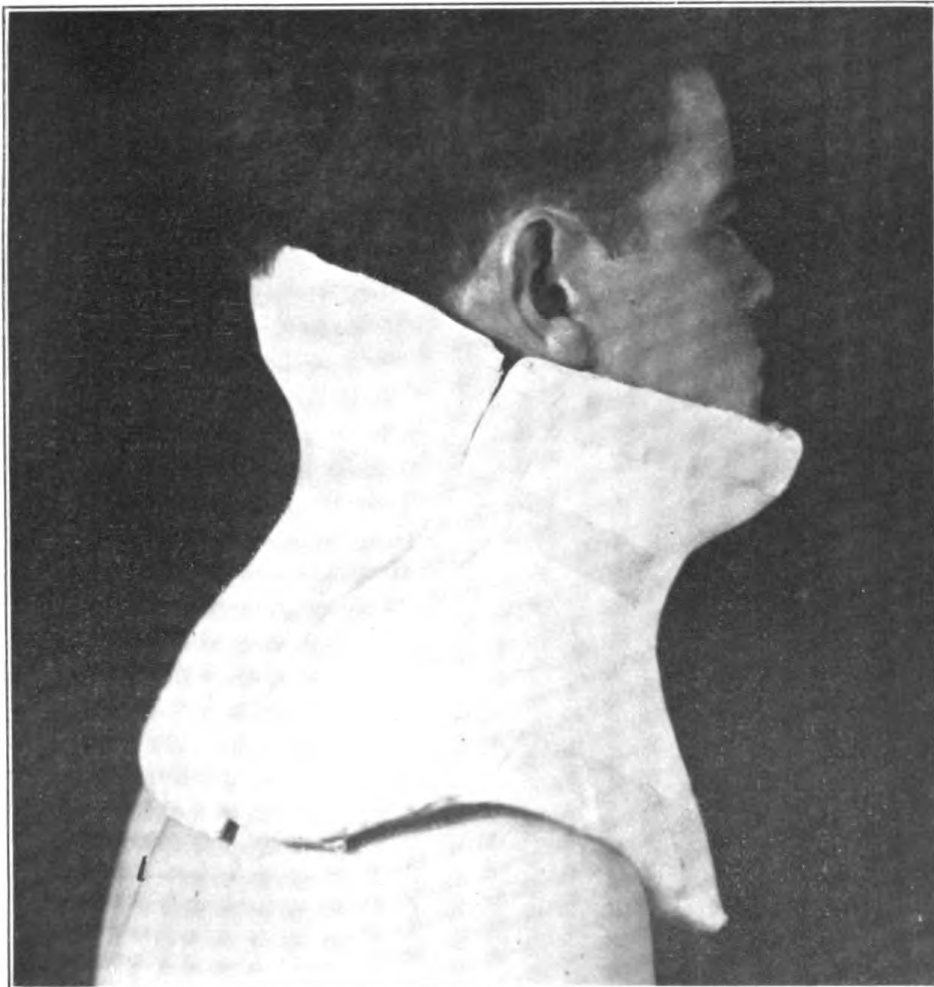


FIGURE 25.—COLLAR PLASTER ENCASEMENT USED IN AMBULANT CARE OF FRACTURE OF THE CERVICAL SPINE

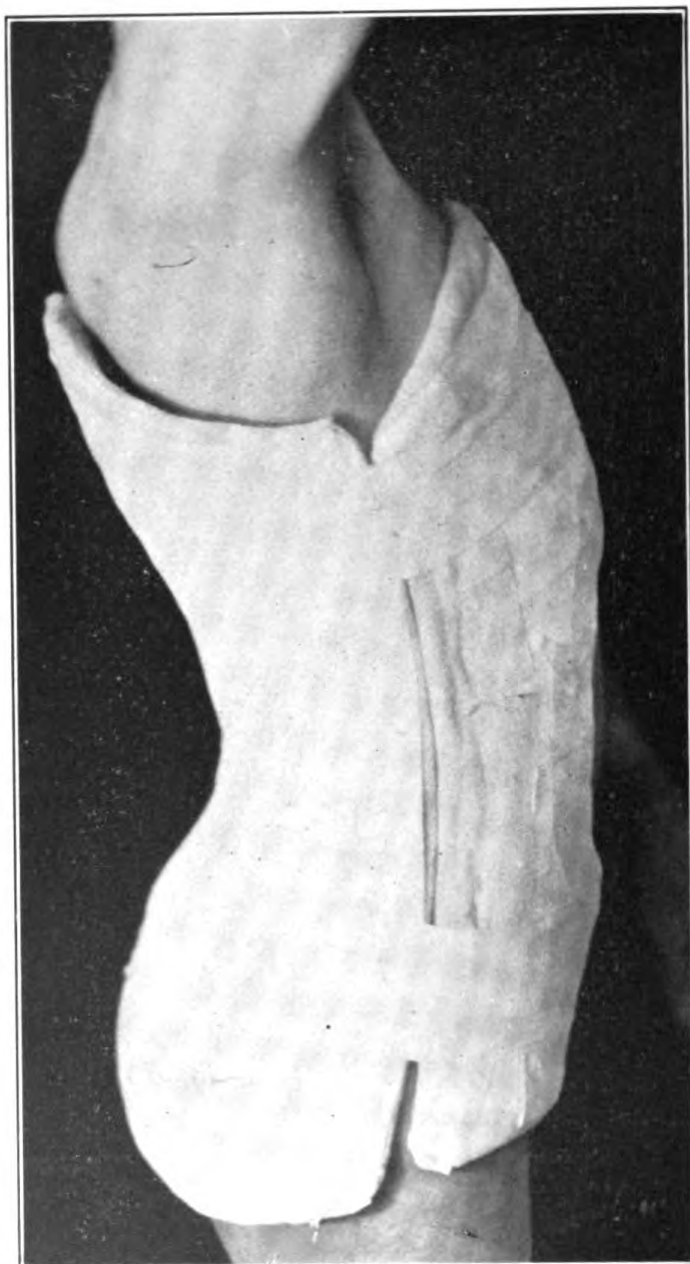


FIGURE 26.—PLASTER JACKET

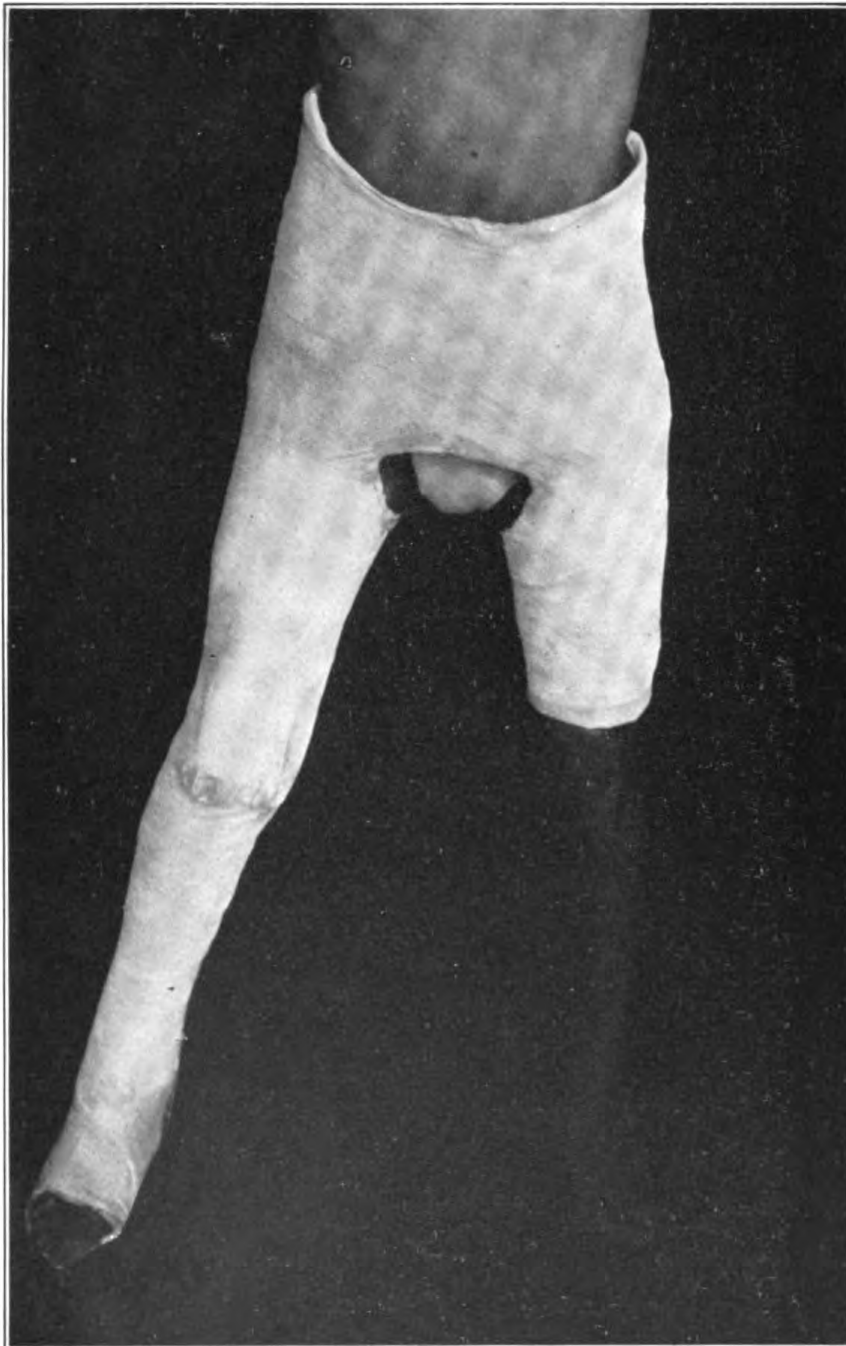


FIGURE 27.—SPICA PLASTER ENCASEMENT. HERE USED WITH PATIENT ON CRUTCHES AMBULANT LATE IN THE TREATMENT OF A FRACTURED FEMUR AS A SUBSTITUTE FOR A WALKING CALIPER

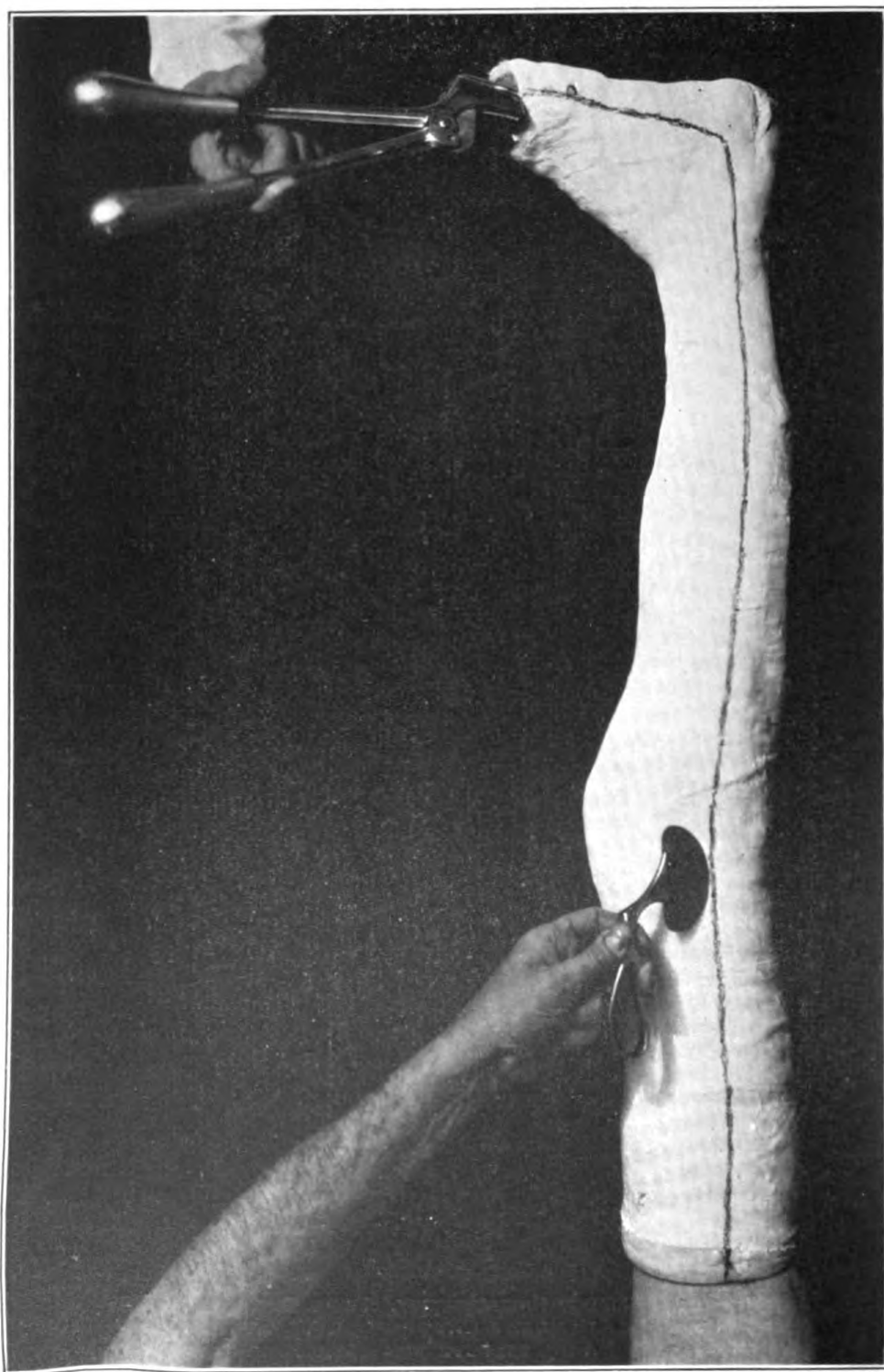


FIGURE 28.—PLASTER ENCASEMENTS ENDANGER BLOOD AND NERVE SUPPLY. IF BIVALVED TO THE SKIN IMMEDIATELY, CIRCULAR CONSTRICTION WITH ITS THREAT OF ISCHEMIA AND PARALYSIS IS AVOIDED

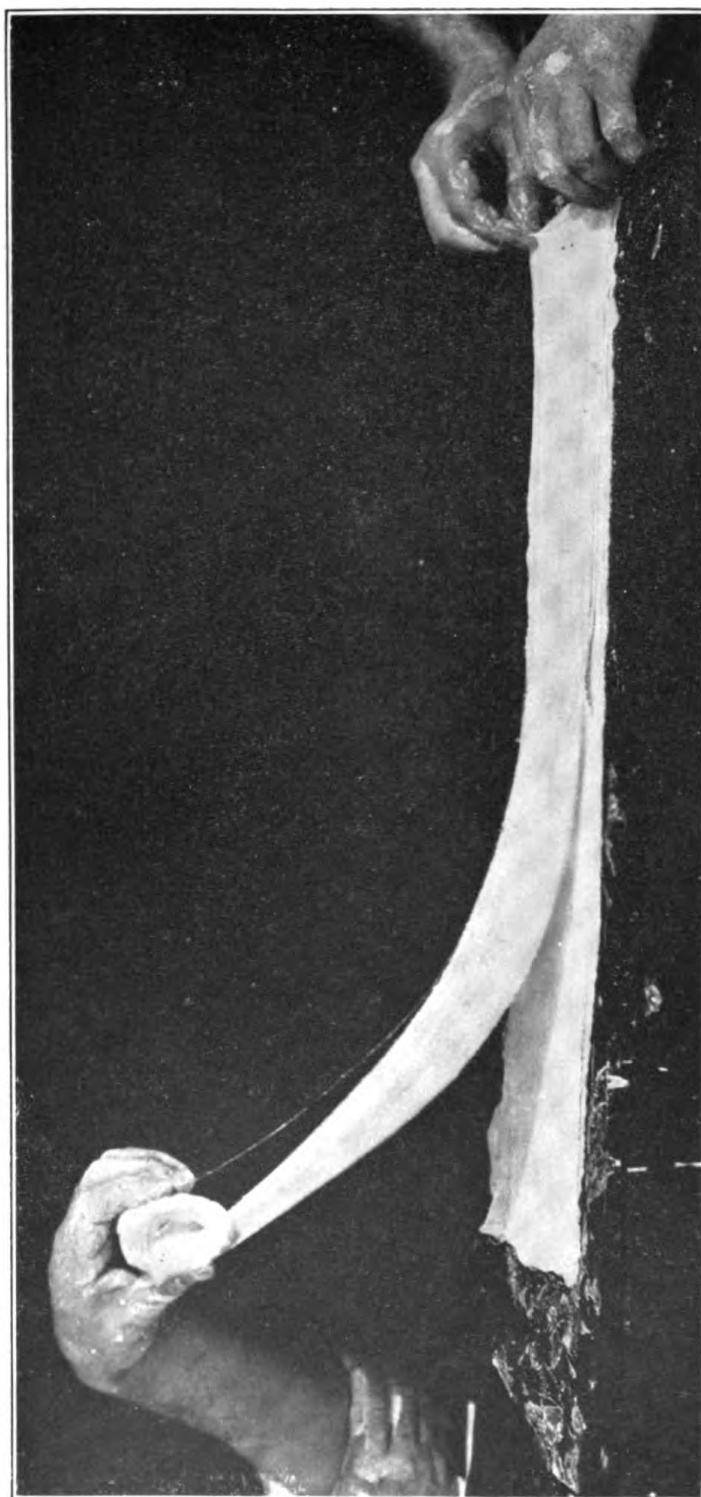


FIGURE 29.—ROLLING A WET PLASTER BANDAGE ON A FLAT SURFACE TO MAKE A PLASTER SPLINT

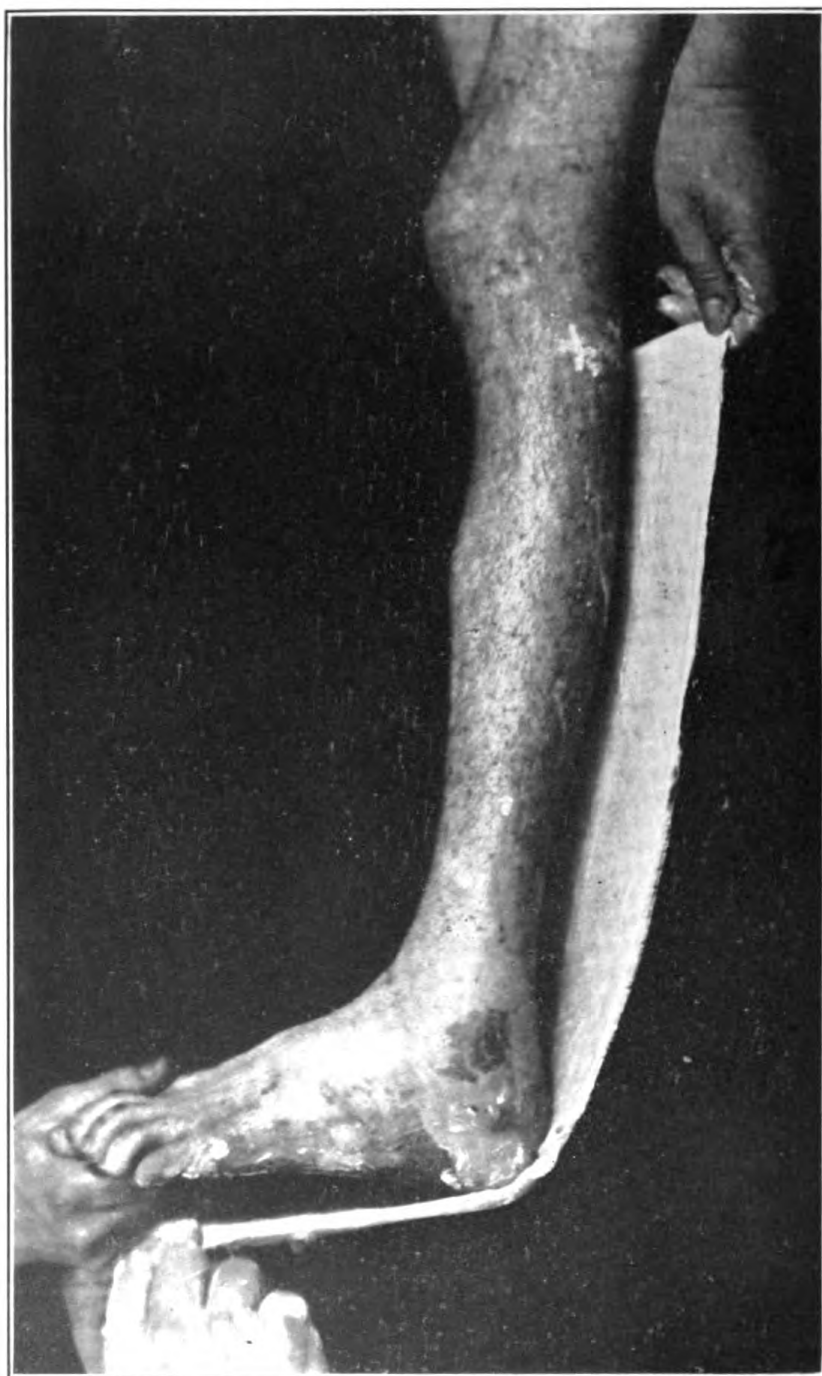


FIGURE 30.—HOLDING THE SOFT PLASTER SPLINT IN PLACE. NOTE THAT NO PADDING IS USED

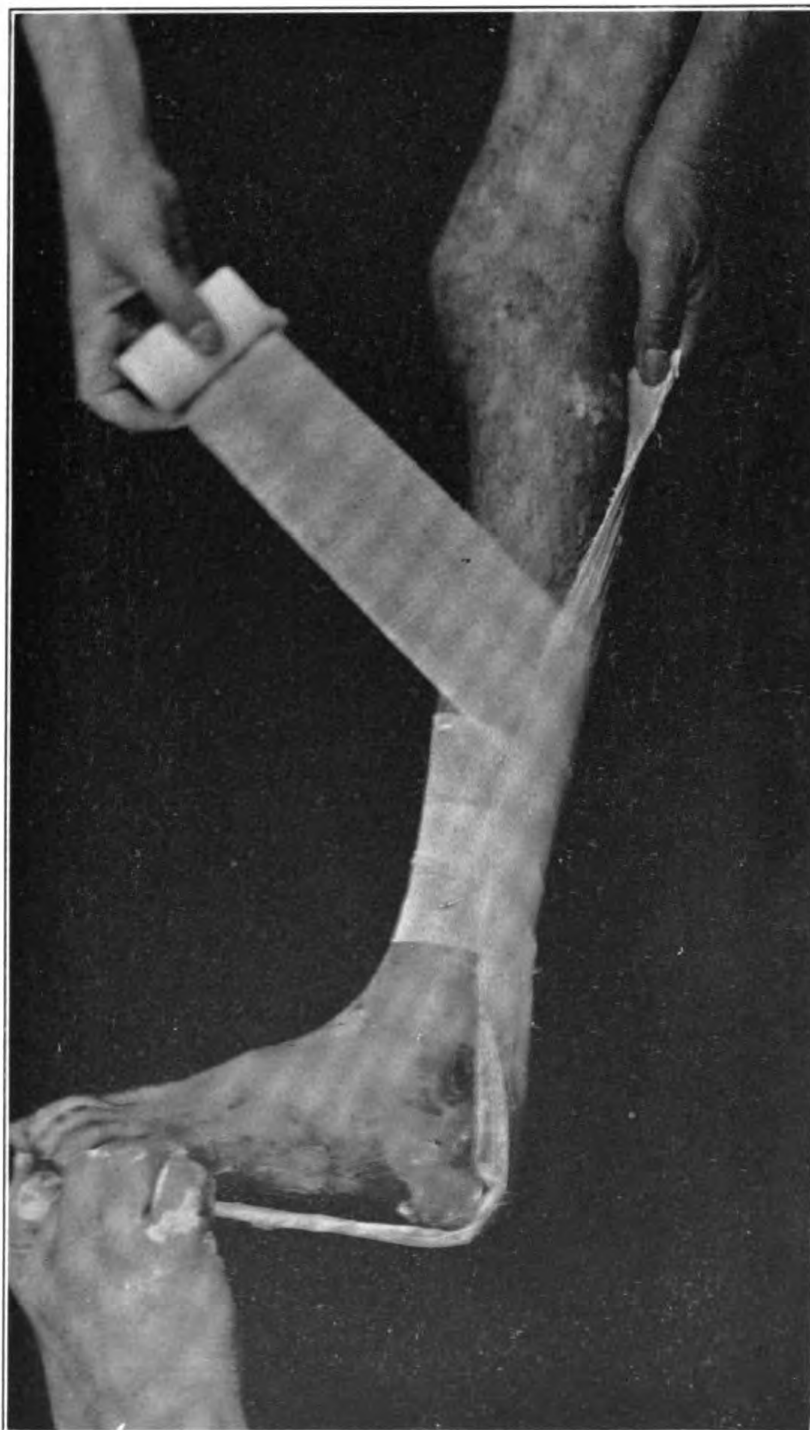


FIGURE 31.—THE SOFT PLASTER SPLINT IS BANDAGED INTO PLACE MOLDING IT EXACTLY TO THE CONTOUR OF THE EXTREMITY

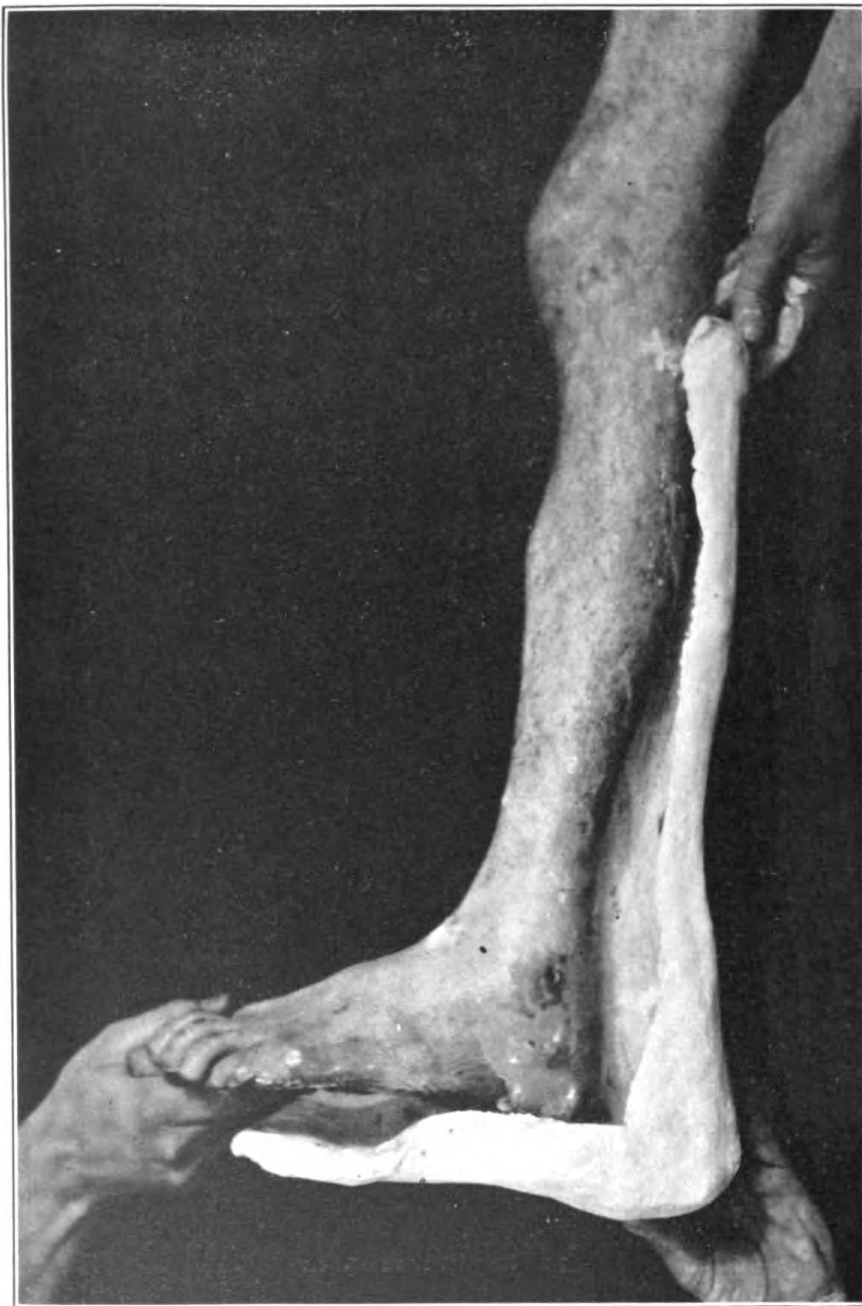


FIGURE 32.—WHEN HARD THE MOLDED PLASTER SPLINT, PROPERLY MADE, FITS EXACTLY, DOES NOT CAUSE PRESSURE SORES AND MAY BE READILY AND SAFELY REMOVED AND EASILY REAPPLIED FOR PHYSIOTHERAPY WHEN INDICATED

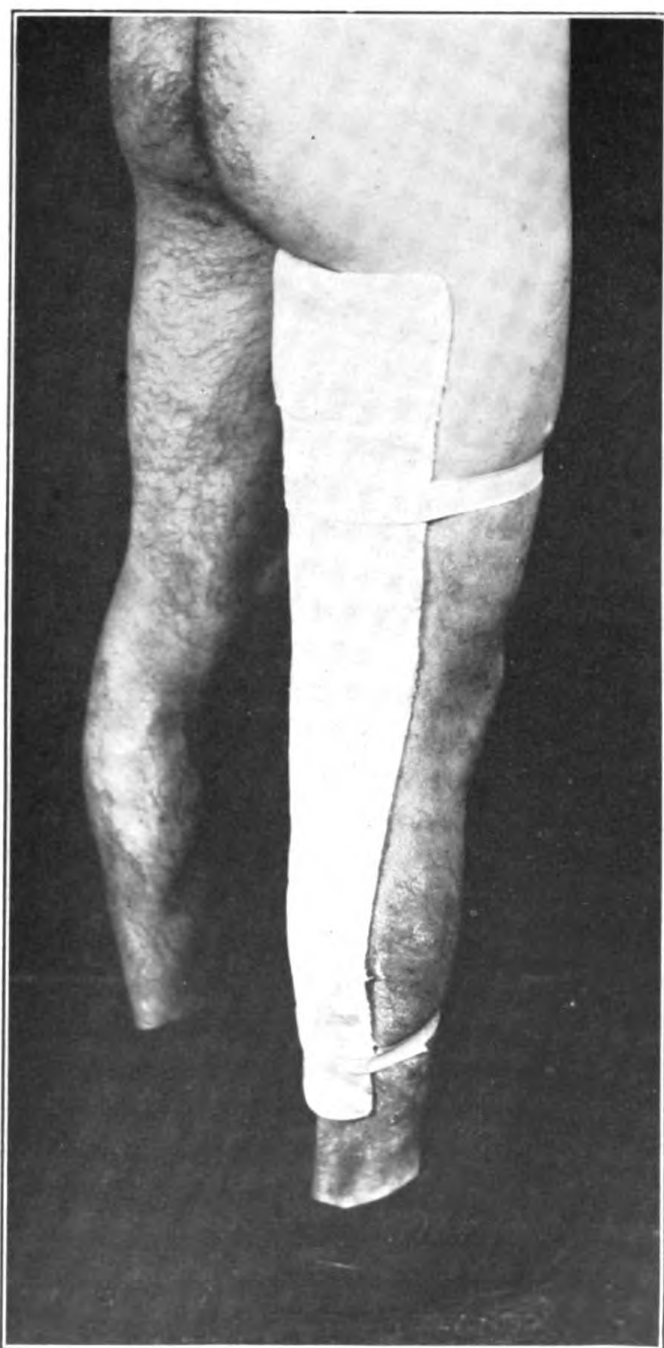


FIGURE 33.—THE POSTERIOR MOLDED SPLINT FOR
MAINTAINING EXTENSION AT THE KNEE JOINT



FIGURE 34.—APPLICATION OF THE LATERAL SECTION OF THE STIMSON MOLDED PLASTER SPLINT. CARE OF POTT'S FRACTURE

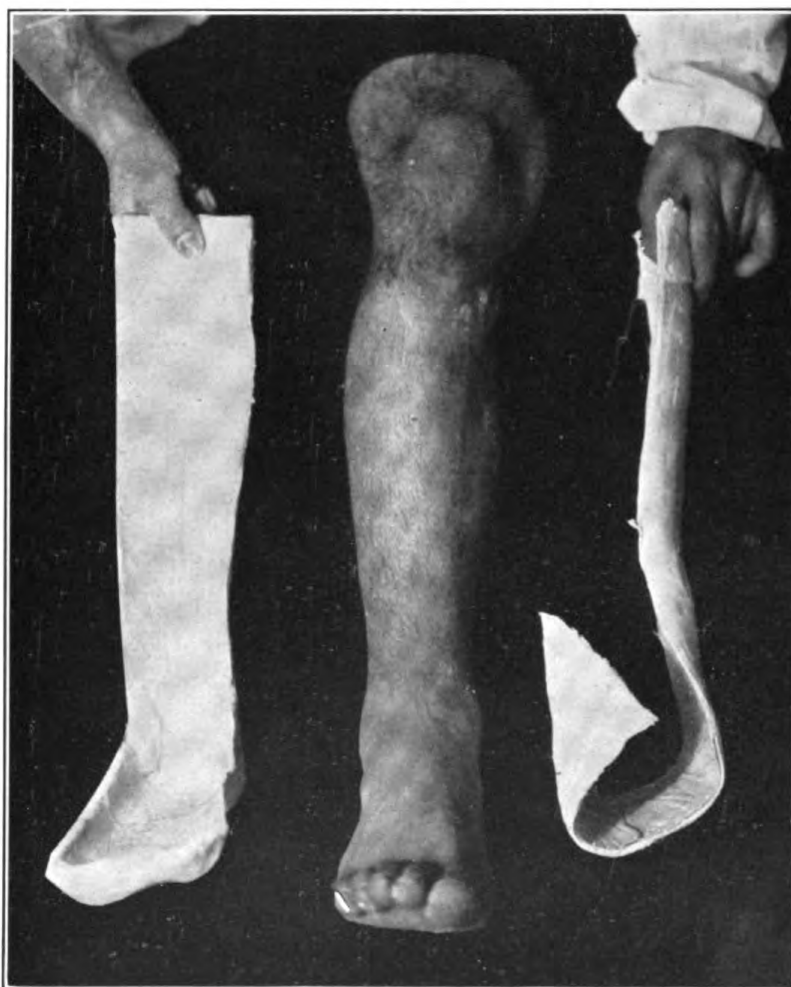


FIGURE 35.—THE STIMSON POSTERIOR AND LATERAL MOLDED PLASTER SPLINT REMOVED TO ILLUSTRATE THE SHAPE AND FIT

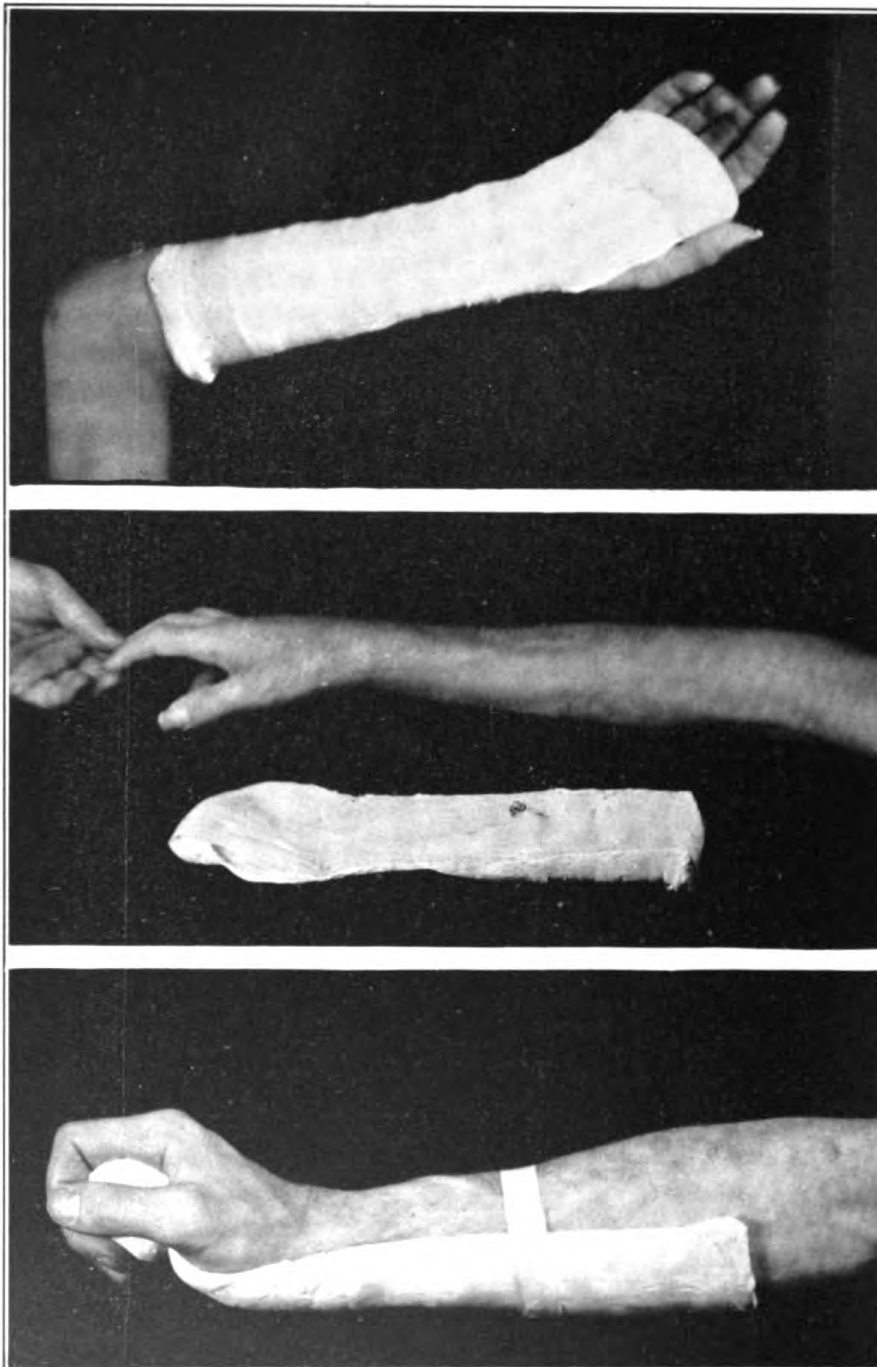


FIGURE 36.—UPPER, ULNAR FLEXION MAINTAINED BY A MOLDED PLASTER SPLINT IN A CASE OF COLLE'S FRACTURE. MIDDLE, THE PLASTER MOLDED SPLINT OF THE ARM REMOVED FOR PHYSIOTHERAPY. LOWER, THE "COCK-UP" ANTERIOR MOLDED PLASTER SPLINT

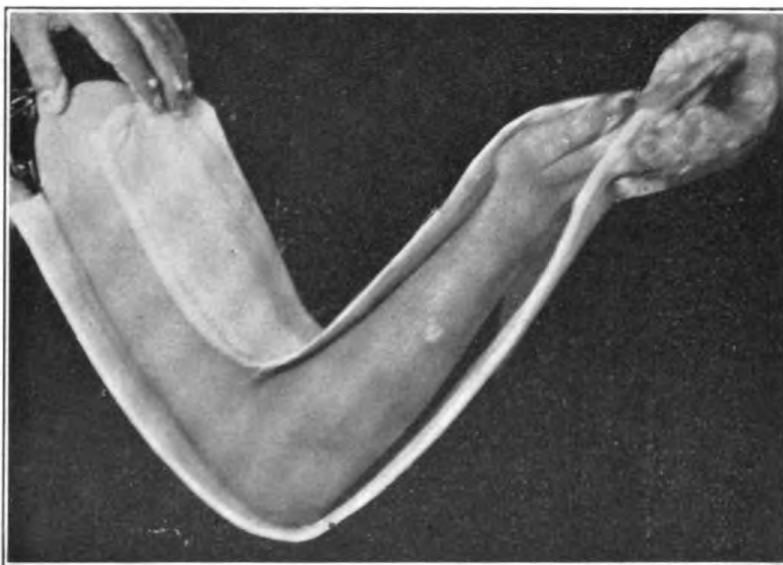


FIGURE 37.—PLASTER SPLINTS SOFT READY TO BE BANDAGED AND MOLDED INTO PLACE FOR FRACTURE BOTH BONES OF FOREARM AFTER REDUCTION AND BEGINNING UNION



FIGURE 38.—A MORE COMPLICATED BUT READILY APPLIED AND USEFUL PLASTER MOLDED SPLINT FOR RETENTION OF A FRACTURE OF THE SHAFT OF THE HUMERUS AFTER REDUCTION



FIGURE 39.—THE ABDUCTION SPLINT MAY BE MADE OF PLASTER. A CASE OF FRACTURE OF THE SURGICAL NECK OF THE HUMERUS

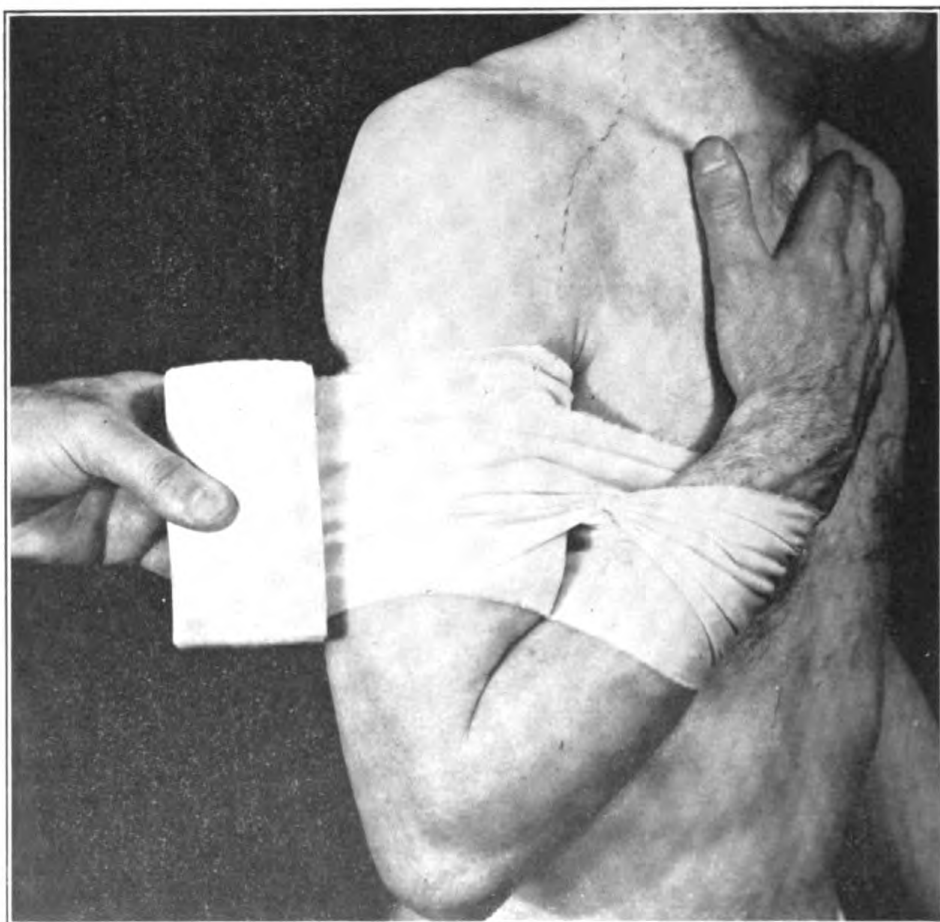


FIGURE 40.—THE MOORE FIGURE OF EIGHT BANDAGE FOR ACUTE FLEXION IN SUPRACONDYLAR FRACTURES OF THE HUMERUS IS NOT MADE OF PLASTER BECAUSE OF THE GREAT DANGER OF DAMAGE TO THE VESSELS IN THE CUBITAL SPACE

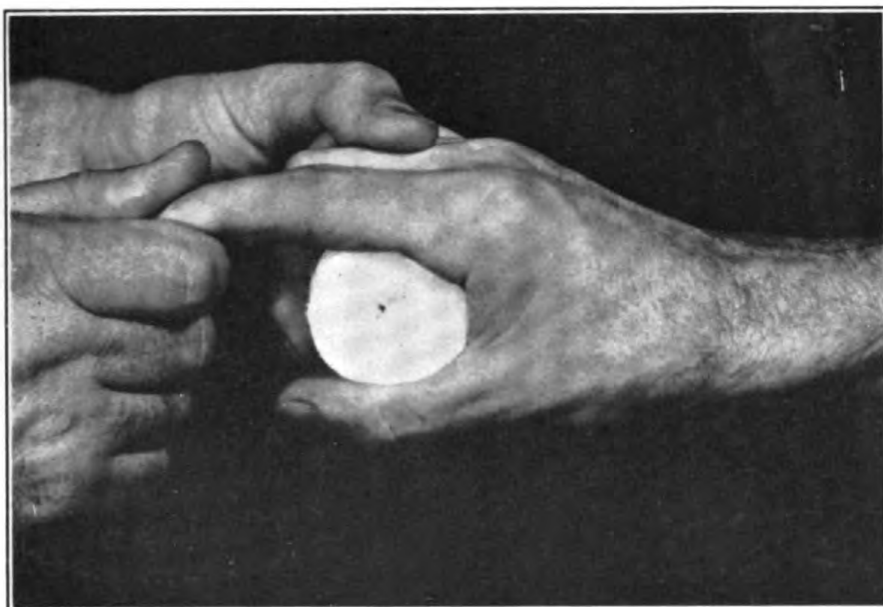


FIGURE 41.—THE REDUCTION AND RETENTION OF A FRACTURE OF A METACARPAL BONE IS GENERALLY BEST ACCOMPLISHED WITH A GAUZE RATHER THAN A PLASTER BANDAGE

CLINICAL NOTES

GRADENIGO'S SYNDROME

A CASE OF PROBABLE PETROSAL TIP SUPPURATION

By C. J. BROWN, Lieutenant Commander, Medical Corps, United States Navy

This combination of symptoms was first described as a syndrome by Gradenigo in 1904. The typical clinical picture is characterized by diplopia, due to homolateral abducens paralysis and pain in the temporoparietal region of the affected side, with an acute otitis media (Ballenger) (1).

Sears (2) in 1926 published an excellent analysis, including an extensive bibliography and a tabulation of the findings noted in 172 cases taken from 126 authors. Kopetzky and Almour (3) are publishing a series of articles on suppuration of the petrous pyramid. Last year Friesner and Druss (4) reported 15 cases of external rectus paralysis. The interested reader is referred to these articles for detailed consideration of the subject.

The prognosis for recovery from the paralysis is considered extremely good. The case mortality is variously given—in Sears's group of 172 cases it was 18 per cent.

Gradenigo gave as the anatomicopathologic process an extension of the middle ear infection through the peritubal air cells and the carotid canal to a large cell at the apex of the petrous pyramid, resulting in an osteitis, circumscribed pachy- or lepto-meningitis, edema of structures about the sixth nerve in Dorello's canal, with consequent pressure on the sixth, inducing paresis or paralysis.

According to Sears (2), many instances of this syndrome may be due to an entirely different pathologic extension of the tympanic suppuration than that described by Gradenigo. Explanations advanced by authors who gave a pathologic diagnosis were: Serous or protective meningitis; inflammatory edema at the apex of the petrous; edema of the brain, with increased intracranial pressure; toxic neuritis; extension of inflammation from the lateral sinus and bulb via the inferior petrosal sinus; extradural abscess; encephalitis; abscess at the apex of the petrous. The great majority of these represent pressure in some form, which is most likely to occur in many of the cases on the sixth nerve in Dorello's canal. In 21 cases the palsy of the sixth nerve was definitely associated with sinus thrombosis.

Routes of infection given are: (1) Direct extension of tympanic pus via contiguous cells to the apex of the pyramid (most apt to occur in extensively pneumatized bones); (2) less commonly through the labyrinth by way of the oval or round windows, or a necrotic promontory, to the cells surrounding the labyrinth and thence to the apex; (3) via the internal auditory meatus or ductus and saccus endolymphaticus; (4) passage of infection along carotid canal.

Among the indirect routes are: Via venous channels from the tympanum to the petrosal sinuses, the carotid plexus, and the jugular bulb; congenital dehiscences in the floor of the tympanum, or roof of the epitympanum; as well as minute canaliculi for the passage of vessels and nerves; via the lymphatic systems.

Kopetzky and Almour (3) in their discussion of suppuration of the petrosal tip give the following avenues of infection: (1) From the antrum or epitympanic space, above or below the superior semicircular canal, following the posterosuperior surface of the petrosal into the pyramidal tip; (2) from the peritubal cells into the pyramidal tip; (3) from the peritubal cells directly into the carotid canal or through dehiscences in the anterior tympanic wall into the carotid canal and then rupturing into the cavum Meckeli.

The following case report is that of a young man, age 20, who developed Gradenigo's syndrome after 2 months of suppurative otitis and 16 days after simple mastoidectomy. Three months later the patient required radical mastoidectomy for the relief of persistent aural suppuration and trigeminal pain.

The duration of the paralysis was 10 months. It was accompanied early in its course by retro-orbital, temporoparietal, and occipital pain which gradually increased in severity. The paralysis and pain persisted until radical operation was done, which was followed by rapid improvement. At the original simple operation the lateral sinus was found bathed in pus, the bone was pneumatic in type, there was considerable bone destruction, and the causative organism was a hemolytic streptococcus. There was no optic neuritis at any time; the spinal fluid was under slightly increased pressure; the cell count was normal.

CASE REPORT

On December 30, 1929, J. G. L., yeoman, third class, age 20, was admitted from the U. S. S. *Arkansas*.

Following spontaneous perforation of the ear drum, he had had a discharge from the left ear for 10 days prior to admission. There had been no previous ear trouble since December, 1927, at which time the ear had discharged for four days, unaccompanied by pain. He did not appear ill; the temperature on the evening of admission was 99.5; pulse and respiration were normal. The general physical examination was essentially negative.

Ear, nose, and throat examination.—Right ear normal. Left ear: The canal was filled with mucopurulent secretion; there was slight sagging of superior

wall, the drum was subacutely inflamed, was thickened in its upper portion, and there was a small perforation in the lower anterior quadrant. Slight antral tenderness on firm pressure. The tonsils were small and chronically inflamed.

X-ray examination.—Some sclerosis of left mastoid process, with thickening of wall of lateral sinus. No evidence of bony absorption such as would be expected in abscess formation. Right mastoid shows a generous amount of pneumatic structure normal in appearance.

Laboratory reports.—Urine: Trace of albumin. Blood: Kahn negative; white count, 8,850; neutrophils, 62 per cent; lymphocytes, 34 per cent; large mononuclears, 2 per cent; eosinophiles, 2 per cent; coagulation time, 3 minutes.

Course.—Tonsillectomy on January 6, 1930. Uneventful healing. The mastoid tenderness disappeared shortly. The ear continued to discharge profusely and the temperature oscillated irregularly between 98 and 100. The leukocyte count and differential remained essentially unchanged. Patient had no discomfort until February 4, when he complained of headache on the left side. There was no distinct mastoid pain or tenderness.

Operation.—Under ether anesthesia simple mastoid operation was performed on February 5, 1930. Findings: The cortex was thick; infected cells extended to antrum. There was a large cell posterior to the lower portion of the lateral sinus. The sinus plate was necrotic. There was free pus about the sinus, which was exposed for five-eighths inch and appeared to be normal above, but was covered with granulation tissue below. This was not disturbed. Cells were thoroughly cleaned out, including those at the root of the zygoma. Wound closed with skin clips, gauze drain to antrum.

Laboratory findings.—Stained smear from antral pus showed Gram-positive diplococci, intra- and extra-cellular. The culture was positive for hemolytic streptococci.

Postoperative course.—There was a slight postoperative rise of temperature, after which it remained normal to February 26. Daily dressings.

On February 21 the patient noted double vision when gazing to the left. Examination revealed a paresis of the left external rectus. The pupillary reactions were normal; fields of vision were normal; there was no pathology in the fundi. He could not abduct the eye beyond the straight-ahead position. There were no other symptoms except transient headache. The discharge via the canal was profuse; an unusually small amount escaped through the postauricular wound. The white count was 10,150. Differential: Neutrophils, 72 per cent; lymphocytes, 26 per cent; large mononuclears, 1 per cent; transitionals, 1 per cent. Believing that there was some interference with drainage or some source of suppuration not discovered at operation, on February 26 wound was reopened under ether. Granulations were removed; the antral opening was enlarged; the zygoma was further investigated. No additional infected areas were found to account sufficiently for the large amount of pus draining from the middle ear. The aditus was adequate in size.

The headache gradually disappeared; the temperature remained below 99 to March 28.

On March 5, 1930, there was no headache. The diplopia had diminished; patient could abduct left eye 45° from straight-ahead position. Tangent curtain examinations made. Fundi remained normal. The white and differential counts were normal.

March 12, 1930: Doing well. No headache. Temperature remains normal. Appetite is good. There is a profuse discharge through the canal, very slight through postauricular wound. Irrigation of wound shows a wide connection with middle ear space.

March 19, 1930: Patient complains of severe pain over left side of head and in retro-orbital region, which recurred.

March 20, 1930: *Spinal puncture*.—Pressure, 12 millimeters of mercury; fluid clear; cells, 5; colloidal gold negative; no globulin increase. Fundi normal; temperature normal.

March 28, 1930: No appreciable change in condition. Patient has recurring frontal headache. Up and about. Visual fields normal for form and colors. Diplopia unchanged.

April 7, 1930: The temperature since March 28 has touched 99.5 and 100 daily. Heart and lungs normal; X-ray chest negative. Röntgenologist reported apparent removal of all cell structure of mastoid. X-ray sinuses essentially negative, except for "veiling of right maxillary and posterior ethmoidal cells on left, the appearance being suggestive of chronic mucous-membrane involvement." White count remains below 10,000; differential normal. Patient has pain in frontal and retro-orbital region each night, for which salicylates are given. No nausea nor vomiting; appetite fair. Fundi normal; diplopia unchanged.

April 22, 1930: Condition has remained about the same, although pain on left side of head has been more severe. Temperature from 98 to 99 daily; pulse normal. No vertigo, vomiting, or nystagmus. Mentality clear. Fundi normal; eye condition unchanged. The discharge through the canal remains unusually profuse and is now green in color; the posterior wound is practically dry. White count, 10,300. Differential: Neutrophiles, .68 per cent; lymphocytes, 28 per cent; large mononuclears, 2 per cent; eosinophiles, 2 per cent.

April 12, 1930: Temperature now touching 99.5 and 100 each evening. The aural discharge remains profuse and purulent. Fundi normal. The pain is now no longer retro-orbital, but frontal and temporoparietal pain persists, requiring codein and luminal at night. Patient has occipital headache at times. He does not feel so well; loss of weight is apparent.

Spinal puncture.—Pressure, 20 millimeters of mercury; fluid clear; cells, 2; colloidal gold negative; no globulin increase; Kahn negative.

April 15, 1930: Pain continues, increased in severity, temporoparietal and occipital in type, requiring codein every night. Temperature, 99 to 99.5. Neurologist found no evidence of abscess.

Because of persistence and character of the aural discharge, the increased pain, the septic temperature, and the unsatisfactory condition of the patient, radical operation was deemed indicated. Some involvement of the meninges was suspected.

Operation.—Radical mastoid operation was done on May 16, 1930, under ether anesthesia. A large area of dura was exposed over the roof of the middle ear and antrum. The inner table was very thin. The dura was red and congested in appearance and there was an excess of fluid beneath it. No granulations nor adhesions were seen. The opening was enlarged as far as possible. The middle ear and the Eustachian orifice were filled with granulations. No gross areas of suppuration or necrosis were found. Because of the large area of dura exposed and the possible necessity for further exploration, plastic flaps were not made at this time. The wound was left open except for a clip above and below. Patient reacted well.

Postoperative course.—May 19, 1930: Patient is comfortable. Has much less pain and is free of it for three and four hours at a time, and feels decidedly better. No longer has diplopia at near and there is less separation at a distance. Temperature to 100.5 at night; pulse normal. Skin clips removed.

June 2, 1930: Temperature has been normal since May 20, 1930. Considerable drainage from canal. Eye grounds negative; fields normal. Feels well, up and about.

June 6, 1930: Spinal-fluid examination: pressure, 18; cells, 4; Kahn negative. Globulin increase, 2 plus; sugar, 57 milligrams per 100 c. c. The globulin increase was considered due to the reaction from operative manipulation.

June 16, 1930: Patient decidedly improved, diplopia less, very little pain, sleeps well, gaining in weight. Temperature, pulse, and respiration normal. Discharge from radical cavity diminishing.

July 1, 1930: Wound reopened; scar tissue excised; plastic metal flap made; Eustachian tube curetted. There was much bleeding at all times. Canal packed; posterior wound closed with clips. Reacted well.

July 15, 1930: Doing nicely. Posterior wound healed, skin from flap growing over radical cavity; meatus adequate in size.

July 31, 1930: Diplopia has almost disappeared; patient gaining in weight; ear practically dry.

Follow-up note.—A letter received from this patient in April of this year stated that the diplopia completely disappeared November 30, 1930. He had some discharge from the radical cavity from October, 1930, to January, 1931, an occasional discharge in January, and none since. He has gained 23 pounds in weight. He has practically no hearing in the operated ear.

It would be very difficult to state definitely the avenue of invasion of this infection. It is believed that this case was an instance of pyramidal-tip suppuration. The findings noted at operation and the course of the disease point quite certainly to the peritubal area as the avenue of escape of the purulent material. No area of infected cells sufficient to account for the large quantity of pus which emerged from the middle ear was found at the time of the radical operation. The infected cells in the mastoid process and vicinity were evidently thoroughly cleaned out at the time of the simple mastoid operation, for at no time during the postoperative course was there much secretion from the postauricular wound, although the mastoid process was markedly involved prior to operation.

The congested appearance of the dura, with the definite increase in subdural fluid, noted at the time of the radical operation and the increased pressure found at spinal puncture suggest a localized edema or serous inflammation of the meninges adjacent to the petrous pyramid.

Points of interest in the case were: The occurrence of paralysis 16 days after the simple mastoid; the retroorbital pain indicating involvement of the first division of the trigeminus; the spread of pain to the occiput; the meningeal findings; the increased spinal-fluid pressure; the great amount of pus from the middle ear prior to operation without demonstrable necrosis in the middle ear or mastoid at time of later radical procedure.

REFERENCES

- (1) Ballenger: Diseases of the Nose, Throat, and Ear. 1930.
- (2) Sears, William H.: Otogenic paralysis of abducens, with especial mention of isolated palsy associated with irritation of gasserian ganglion. (35: 348, June, 1926.
- (3) Kopetzky, S. J., and Almour, R.: Suppuration of the petrous pyramid; pathology, symptomatology, and surgical treatment. *Ann. Otol. Rhinol. and Laryngol.*, 39: 966, December, 1930, 40: 157, March, 1931.
- (4) Friesner, I., and Druss, J. G.: Osteitis of petrous pyramid of temporal bone, associated with paralysis of external rectus. *Arch. Otolaryng.*, 12: 342, September, 1930.

STRANGULATED HERNIA**REVIEW OF TWENTY-NINE CASES, EIGHT OF WHICH REQUIRED
INTESTINAL RESECTION**

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This series consists of 28 strangulated inguinal hernias, of which 7 required intestinal resections and of 1 femoral hernia, strangulated, with resection. The femoral hernia was the only one in this group which occurred in a female patient. All of these cases were observed at the Haitian General Hospital during a period of about two and one-half years. The series was not extensive, perhaps, but was sufficient to prove that the method used in handling such cases was rational and justified.

If there is any condition calling for an immediate surgical intervention, it is a strangulated hernia; all earlier discussions on the various merits of watchful waiting, taxis, etc., as compared to immediate intervention, should be relegated to the limbo of ancient surgery.

Any patient presenting himself with a suddenly irreducible hernia, associated with more or less severe pains and vomiting, should be brought to surgery. Whether it eventually turns out to be a true intestinal strangulation, an omental strangulation, a torsion of the omentum, or an incarceration without true strangulation, the indications would be the same.

Generally in the inguinal and femoral types the diagnosis is quite easy—sudden irreducibility, sharp pains, and tenderness upon pressure in the region of the cul-de-sac, followed by vomiting and a change of facies. Whether these phenomena involve the infant, youth, adult, or the aged, the operative indications are equally urgent.

The earlier the diagnosis and operation the greater the success. This is because of the rapidity with which the process may extend, even going so far at times as to produce gangrene of one or more

loops in a few hours. No longer do we wait to make a complete elaborate diagnosis supported by the laboratory.

All authors agree that four phases of the surgical problem are presented at operation:

1. Locating the site of strangulation.
2. Relieving the constriction.
3. Treatment of visceral lesions.
4. Repair of hernia.

The last phase must necessarily depend upon the patient's condition, but, where possible, a herniorraphy should be performed. It is preferable, all things being equal, to complete in one stage the removal of a condition which is possible of recurrence.

One of the most difficult problems, practically, is the necessary treatment of the intestinal lesions found after careful examination. The importance of this examination can not be overestimated and must include the loop or loops in the sac as well as those adjacent at both the efferent and the afferent ends. This procedure must be carried out even though there has been a spontaneous reduction caused by the anesthetic or other factors. In two of our resection cases the strangulation was relieved in this manner. Viability of viscera is determined by the recognized methods. There should be no possible doubt as to the circulation before the viscera is restored to the abdomen. Mistakes of this sort are responsible for high mortality rates in the so-called simple cases. Nonvital tissue complicates the picture. A small, reddish black area in the intestinal wall—or even frankly gangrenous areas, if small—may be treated by simple invagination. But if the circumference of a section of gut presents the above symptoms, or if the mesentery is thus affected or filled with hematoma and there is no response to the recognized attempts at reestablishing the circulation, a resection becomes imperative.

All the matters just stated were brought forcibly before our eyes by this series of cases.

In this group—all males, with one exception—the ages varied from 1 to 80 years, with an average of 38.6 years, not reckoning the two youngest, ages 1 and 3.

The patients had carried their hernias many years, many being congenital, and gave a history of previously easy reduction by various methods. Consequently most of them were very large—60 per cent of our series—two having gone so far as to have lost the right of domicile in the abdomen. Questioning elicited that the strangulation had previously taken place in a few for short periods, but that neighborly ministrations had sufficed to effect a reduction. The great majority, however, mentioned a sudden painful irreducibility

accompanied by nausea, later vomiting persisting to time of admission. The duration of strangulation in these cases was from 2 to 72 hours, the average being 23 hours. One case gave a history of onset eight days previous to hospitalization.

Their clinical manifestations varied greatly; all but three complained of vomiting and in only two was the vomitus fecal. The febrile reactions were mild except in the most severe cases. Shock was surprisingly rare, but the worried facies were usually present. One man who presented the least symptoms appears in our list as having needed a resection of about 60 cm. of small intestines. All patients presented a localized tender mass, and three showed localized edema.

Anesthesia was given as follows: Regional with novocaine in 24, ether in 4, and spinal in 1. For the regional anesthesia we used the technique of Labat. No analgesic was necessary for the resection group. A preoperative hypodermic of morphine was given.

The customary incision, parallel to Poupart's, was used, the site of constriction exposed, incised, and the sac opened. A careful examination of conditions was then made. A serosanguineous fluid in the cavity always indicated the presence of badly strangulated gut. Conditions appraised, recognized methods at reestablishing circulation were instituted.

Three of our twenty-nine cases necessitated minimal interference due to their poor conditions; thus:

1. P. F., incision in large gangrenous mass to form a fecal fistula. Died in 10 hours.
2. E. J., lateral anastomosis above gangrenous loop with Jaboulay button only. Loop left in wound. Later repaired.
3. B. F., constriction relieved, gut freed, and purse-string closure of cul-de-sac only. Lobar pneumonia at time. Died during the night.

Eight patients needed intestinal resections of lengths varying from about 15 to 60 centimeters. Two presented W-shaped loops in the sac.

One case, St. C. G., 3 years old, required an invagination of a small gangrenous area in the terminal ileum. In the remainder the intestines responded to stimulation provoked by hot salt solution or ether, once the constriction was removed.

No uniform technique for herniorrhaphy was employed; the Bassini or one of its modifications, Stetten or Ferguson, was used. The femoral hernia was repaired by using the inguinal route, thereby greatly facilitating the resection which was necessary. As to the resections, we used the following methods:

	Cases
1. Basting stitch (Kerr-Parker), end-to-end anastomosis.....	7
2. Jaboulay button	1
3. Invagination.....	1

The ordinary postoperative treatment was followed.

There were 3 deaths in this series—1 of the resection cases and 2 for whom practically no surgery was employed; thus:

E. M., dying of peritonitis 3 days after approximately 30 centimeters of ileum had been resected.

B. F., whose hernia became strangulated while suffering from lobar pneumonia and for whom the constriction was relieved by incision only, died during the night.

P. F., whose large gangrenous scrotal mass and moribund condition called for simple incisions only, died in 10 hours.

Our statistics thus showed a total mortality of 3, or 10.3 per cent, for all cases, and in the resection group 1 death, or 12.5 per cent.

In summarizing, we stress the importance of early diagnosis, immediate operation, and very careful search for damaged intestines in the sac and adjacent areas. We noticed the presence of sero-sanguineous fluid in the severe strangulations and the lack of intense shock or fever.

We recommend the use of a local anesthetic in preference to ether and the avoidance of buttons whenever possible. We consider regional anesthesia as not only sufficient but, contrary to some authors, preferable, because of its avoidance of many dangers incident to a general anesthetic under such conditions.

The following statistics are interesting:

Watson, L. F. (1), in his volume on Hernia gives the following table under strangulated hernias:

	Per cent		Per cent
Mikulicz (1891).....	64	Vaughan (1905).....	33.3
Zeldler (1892).....	62	Hesse (1907).....	55
Butz (1892).....	48	Berkofsky (1911).....	32.6
Akerman (1899).....	55	Gussew (1913).....	57
Kofmeister (1900).....	52	Guillaume (1921).....	29

MM. Godard and Palios (2), at Delbet's clinic in Paris, tabulated 121 strangulated hernias operated on from 1924-1929, as follows:

Fifty-three femoral hernias, 36 were simple, with a death; in 13 resection and suture, 5 deaths; 3 with resection and colostomy, 2 deaths; 1 gangrenous, recovery. The inguinal type comprised 50 simple hernias with 2 deaths; 3 with suture after resection, all recovered. Of the 15 others, there were 11 simple ones with 4 deaths—2 with resection and suture died; 1 recovery after resection and colostomy.

REFERENCES

- (1) Watson, L. F.: *Hernia*, 1924, 91.
- (2) Godard, H., and Palios, C.: *Les hernies étrangulées et gangrénées traitées par l'entérectomie avec suture*. *Rev. de Chir., Paris*. 67: 476, July, 1929.
- (3) *Practical Medical Series*, 1930. *Surgery*, 547.

UNDULANT FEVER

REPORT OF A FATAL CASE FROM THE PHILIPPINES

By G. F. COOPER, Lieutenant, Medical Corps, United States Navy, and A. A. MARSTELLER, Lieutenant, Medical Corps, United States Navy

Undulant fever has been reported from the Philippine Islands, as from almost every other country, but cases developing among the American population are of more than passing interest because of the public health problem involved.

It is an easy matter to introduce cases into the United States, and with the increasing number of cases, as evidenced by the large amount of literature in the current medical journals, it may soon be of interest to the public health authorities to find out just what proportions of cases of undulant fever are due to each of the different varieties.

In the case reported below there were many variations from the usual symptoms enumerated in most textbooks, and it is believed that a complete report of the case in detail is of interest in clearing up some of the commonly accepted findings in this type of case.

CASE REPORT

Patient, male; age, 20; well nourished and well developed; height, 66 inches; weight, 145 pounds. Admitted to outside dispensary with the following entry in his record:

"February 20, 1931: Diagnosis undetermined (dengue). Chief complaint: Pain in the back and dizziness. Last night this man was taken ill with a severe pain in the lower right quadrant, which persisted most of the night. There was no nausea or vomiting at that time. This morning he had a severe chill, which lasted for about one hour. During this time he felt nauseated but did not vomit. At present he feels comfortable, except that he is dizzy and feels very hot. Temperature, 104.6° F., pulse, 124. Blood smear at 1.45 p. m., negative for malaria. Transferred to hospital."

Record at hospital is as follows:

February 20, 1931: Admitted to hospital with temperature of 105° F.; pulse, 105; respiration, 22. Face flushed, eyes injected, headache, and general pains throughout body and extremities.

Physical examination.—Head and neck: Essentially negative, except as noted above. Chest: Heart, normal. Lungs: No adventitious sounds made out. Abdomen: No masses, tenderness, or rigidity noted. Leukocyte count, 10,000; neutrophils, 76; lymphocytes, 24.

February 21, 1931: Patient feels much better after a cool sponge and ice cap to head. Temperature down to 102° F.

February 22, 1931: Temperature reached normal to-day. All other symptoms have subsided.

February 23, 1931: Temperature, 100.6. Temperature rose to 104° F. this afternoon.

February 24, 1931: Temperature normal again.

February 26, 1931: Temperature has again risen gradually to 103.6 to-day. No eruption on body has been noted. (Patient presents typical signs of dengue to this point in his history.)

February 27, 1931: Examination of chest shows no adventitious sounds in lungs. Leukocyte count, 9,600; polys, 68; lymphocytes, 30. Blood smear negative for malaria.

March 1, 1931: Widal reaction negative for agglutination in 24 hours, for *B. typhosis*, *B. paratyphosis A* and *B*. Temperature has gone up to 105° F. It has been ranging between 103° and 104° F. Treatment is still symptomatic. Stools examined and found negative for ova or parasites. Stool culture negative for typhoid or dysentery like organisms. Leukocyte count, 11,350; polys, 68; lymphocytes, 32. Smear negative for malaria. Kahn test on blood negative.

March 6, 1931: Temperature continues high. Blood culture on two occasions has been positive in pure culture for a Gram-negative, nonmotile micrococcus which on subculture appears to be a coccoid bacillus. Culturally this organism corresponds to that of the *Brucella* group in not fermenting any of the sugars. Agglutination carried out both at this hospital and at the Bureau of Science in Manila with the organism isolated from the patient's blood gave a titer of 1:1,600 with an *abortus* serum and 1:3,200 with a *melitensis* serum. Later the same organism was isolated from the urine.

Patient's serum agglutinated a stock culture of *abortus* strongly at 1:3,200.

March 9, 1931: Spinal puncture this date. Spinal-fluid culture and Kahn test both negative on 3-10-31. Mercurochrome, 5 c. c. of a 1 per cent solution in 50 per cent dextrose, given intravenously. Temperature dropped 3° in the next few hours, but started to rise again.

March 10, 1931: Temperature continues high. Patient appears to be in a typhoid state. Urine and feces culture negative for typhoid or dysentery. Urine contains almost a pure culture of what is apparently the same organism isolated from the blood; a gram negative, nonmotile diplococcus which is inclined to be either in pairs or short chains. Leukocyte count, 28,450; polys, 96; lymphocytes, 4. Patient is unable to use left arm or leg. Mercurochrome and glucose given intravenously, 10 c. c. of a 1 per cent solution. Patient's temperature comes down 1° to 3° after injection of mercurochrome.

March 11, 1931: Leukocytes, 30, 150; polys, 95, lymphocytes, 5. There are no physical findings in the lungs. Heart shows a blowing murmur in the mitral area. Purpuric hemorrhagic spots have appeared over the face, body, and arms. Also some are noted on the conjunctiva.

March 16, 1931: Patient's temperature began to drop from its continuous high level of 104° F., pulse becoming rapid. Leukocytes, 28,850, polys, 94; lymphocytes, 6. Urine turbid; trace of albumen; numerous bacteria; fine and coarse granular casts; numerous pus casts.

March 18, 1931: Red blood cells, 2,090,000; hemoglobin, 45 per cent; leukocytes, 30,700; polys, 95; lymphocytes, 5.

March 20, 1931: Condition critical. Temperature, 101.2° F.; pulse, 126; respirations, 26. Showing evidence of air hunger. Given hypo of camphor in oil. Patient died at 4.35 p. m.

Body sent to Army morgue, where a complete evisceration is done on all cases in order to embalm properly in this climate. A report of the gross pathology of the organs is as follows:

"General appearance of internal organs, that of sepsis. No evidence of typhoid; no ulcerations of intestines. These were greatly distended and congested. Liver greatly enlarged and septic. Lungs consolidated in upper lobes.

Heart dilated and enlarged. Spleen greatly enlarged, friable, and hemorrhagic. Pancreas hemorrhagic."

SYMPTOMS IN DETAIL

Temperature.—Continuous, with slight undulations, but never reaching normal. Ranged between 103° and 104° F. most of the time.

Circulatory system.—Rapid pulse in later stages. Soft blowing systolic murmur. Positive blood culture. Anemia, and leukocytosis, mostly *neutrophiles*.

Respiratory system.—Lungs were clear up to last day. However, autopsy showed consolidation of both upper lobes. Respirations on morning of day of death were 22.

Nervous system.—Headache; joint pains; paralysis of left leg and arm; low muttering delirium after second week; spinal fluid negative in every way.

Alimentary tract.—Diarrhea. Involuntary bowel movements, and voiding. One slight hemorrhage of several ounces of bright blood. Tenderness over abdomen and spleen.

In the case reported here the patient developed small petechial hemorrhages in the skin and conjunctiva, which became purpuric. His liver and spleen became large and tender in the third week of the disease, but he showed no jaundice at any time. His reflexes were normal, except on paralyzed side.

LABORATORY EXAMINATIONS

Blood cultures on two occasions were positive in pure culture with a small Gram-negative, nonmotile micrococcus, which tended to appear in pairs or short chains. On subsequent cultures they had the appearance of short coccoid bacilli.

Colonies on agar had a golden appearance, but were clear. Agglutination with *A. melitensis* serum 1:3,200. Agglutinated with *A. abortus* serum 1:1,600. Good growth on fermentation tubes of saccharose, lactose, dextrose, mannite, xylose, peptone, and in broth. No gas or acid formation in any of the fermentation tubes. Colonies on Endo were grayish and resembled typhoid growth, with the exception of a slight discoloration at the center of the colony by direct light.

Patient's serum agglutinated a stock culture of *A. abortus* in a dilution of 1:3,200. Widal was negative at all times for *B. typhosis* and *B. paratyphosis A and B*.

Culture from urine positive from about the ninth day, and organisms had all of the characteristics of those in the blood.

LEUKOCYTE COUNTS

February 24, 1931: 10,000, polys 76, lymphs 24. Malaria negative.
February 27, 1931: 9,600, polys 68, lymphs 30.
February 28, 1931: 11,350, polys 68, lymphs 32.
March 1, 1931: 11,300, polys 82, lymphs 18. Mercurochrome intravenous.
March 9, 1931: 30,150, polys 95, lymphs 5.
March 10, 1931: 28,450, polys 96, lymphs 3.
March 16, 1931: 28,850, polys 94, lymphs 6.
March 18, 1931: 33,700, polys 95, lymphs 5.

BLOOD CULTURE

March 4, 1931: Positive for *Brucella* group.
March 6, 1931: Positive for *Brucella* group.

ANIMAL INOCULATION

On March 5, 1931, a guinea pig was inoculated with 2 c. c. of a broth culture of the organism isolated from the blood culture. Pig killed on March 24, 1931, showed enlargement of liver and congestion of organs, but no tubercle formation or other gross pathology. Cultures from the gall bladder showed no growth in 24 hours. Examination of culture on blood serum agar revealed no organisms. In 72 hours cultures were still sterile.

Culture on fourteenth day was positive for a Gram-negative coccus nonmotile and morphologically and culturally *Brucella melitensis*. Agglutination and absorption tests were not made to determine whether this organism was of the *melitensis* or *abortus* variety.

EPIDEMIOLOGY

1. This patient's home is in Ohio, where there are several endemic areas from which infection with *abortus* have been reported—63 cases from Dayton alone in the past year. Some writers have suggested the possibility of an infection months or years previous, in which it might be possible to have a slight infection and a carrier state in the gall bladder, this causing an acute flare-up when the patient's resistance is lowered by some other acute condition. This is rather far-fetched in this case.

2. Several cases were being treated among the marines in Shanghai at about the time this patient was taken ill. He had been in Shanghai on duty until September 30, 1930.

3. The symptoms in this case were typical of dengue or catarrhal fever at the onset, even to eyeball pain and bone and joint pains. The temperature chart was characteristic until about the fourth day after admission.

4. This patient had been confined in the naval prison at Cavite for several months before admission to the sick list, so that the

probable source of infection was in handling fresh meats from Australia, unless he had a dormant infection in his gall bladder which had existed since his duty in Shanghai, China.

CONCLUSIONS

1. A case of undulant fever is reported which has many symptoms and characteristics not typical of those usually found or reported.

2. Unusual symptoms and findings are:

- (a) Sudden onset, and resemblance to dengue.
- (b) Relatively high leukocytosis.
- (c) Typhoid state.
- (d) Paralysis of left leg and arm early in disease.
- (e) Diarrhea and hemorrhage.
- (f) Purpura of skin and conjunctiva.
- (g) Urinalysis negative until the twenty-fourth day.
- (h) Involuntary voiding and bowel movements.
- (i) Muttering delirium.
- (j) Leukocyte neutrophile increase and low lymphocytes.

3. It is believed that many slight cases are never diagnosed, as several are brought to mind in which there has been an original admission for dengue which lasted five or six days, and returned to duty. Then readmission with practically the same symptoms three or four times at 2-week intervals. It is thought that blood cultures might clear up obscure fevers which extend over a considerable period of time with remissions in between.

4. In the case reported it is believed that a septic endocarditis developed in the last few days. The patient was completing one undulation of almost three weeks' duration, and temperature was at lowest in three weeks, when he died, probably from the pneumonia, endocarditis, or a combination of the two.

UNDULANT FEVER IN CHINA

REPORT OF A TYPICAL CASE

By F. M. ROHOW, Lieutenant, Medical Corps, United States Navy

The purpose of this paper is not to show the existence of undulant fever as a new disease in the areas inhabited by naval personnel in China, but to point out its probable existence in China for many years. All of the sources for the transmission of this protean disease are present in China in the forms of the caprine, bovine, equine, and porcine varieties and by way of human excretions.

The possibilities of contracting undulant fever of caprine origin in China can easily be seen when one witnesses herds of goats being driven along the streets. No doubt goat's milk is used as one of the sources for milk supply and is substituted for cow's milk in many areas.

A rather unusual sight is the method in which the natives obtain fresh mare's milk while the customer waits for his cup to be filled. The milkman heralds his approach by the tinkling of a bell hung from the horse's neck. This has been a custom for many years, especially in the feeding of children. It is thought by some of the natives that milk from a white horse when drunk warm has some peculiar protective properties, as well as curative, against disease.

The ease in which infection from bovine sources may be transmitted is readily seen when one's attention is drawn to reports of unlicensed dealers in Shanghai selling adulterated milk in bottles bearing the label of a licensed dairy.

The porcine variety may be the least offender, due to the meat being officially inspected and bearing the stamp of the municipal council, but the usual avenue for infection of the meat handlers exists, especially at the abattoirs. Fresh meats of all kinds, including pork, beef, fowl, and rabbits, may be seen hanging in open shop windows adjacent to the street and directly exposed to the dust and dirt heavily laden with microorganisms of all kinds. In this manner pork may become infected after leaving the abattoir by excreta which has been deposited on the streets by goats and other animals capable of harboring the organism.

To some extent the human source may also be an avenue for the spread of this infection by way of dust and dirt. It is the custom of the poorer class of Chinese living in Shanghai to use buckets or containers for the depositing of human excreta. This in turn is collected in tanks by Chinese men and women. The splashing and dripping from these tanks on the crowded streets in a semitropical country offers an excellent source for the transmission of this disease.

We are particularly concerned at present with the type of undulant fever caused by the *Brucella melitensis* var. *melitensis*, and the possible source of infection. From the history obtained it developed that certain enlisted men of the United States Marine Corps were in the habit of sending out for sandwiches and milk when they felt hungry during the evening. When questioned about the source of the milk they were unable to give any information other than it was purchased from a Chinese. The bottles did not bear the cap of a licensed dairy, and no information could be gained from the Chinese as to whether it was cow's milk and whether it had been pasteurized. The sandwiches were usually made of native pork, which added to the possibility of contracting the disease by this route. In all proba-

bility the milk contained the organism and was the source of the infection. The question of which type of infection existed was decided upon following negative tests for all varieties of *Brucella melitensis* except *B. melitensis* var. *melitensis*, which gave a positive agglutination of the blood in a dilution of 1-240. This titer was arrived at by using two dilutions, beginning with 1-20 and 1-30, respectively. Culture and agglutination tests were done in a civilian laboratory conducted by a European physician. Consequently, requests for laboratory data were only made when necessary, due to the expense incurred; therefore no cultures were made of the suspected milk or from the patient's urine.

An interesting feature, as seen below, in the case record is the periodical excessive perspiration which drenched the linen of the patient and of the bed to such an extent that it was necessary to change the mattress. Another interesting feature, but distressing to the medical officer, was the apparent well-being of the patient and the persistent lack of complaints regardless of the temperature range.

REPORT OF CASE

Pvt. P. N. W., U. S. M. C., a white male, aged 19 years, was admitted to the regimental hospital at Shanghai, China, on November 19, 1930.

Present illness.—Present illness was first noticed by him several days prior to admission to the sick list. His chief complaints are chilly sensations, fever, anorexia, restlessness, and general malaise. When admitted to hospital the temperature was 104°; pulse, 102; respiration, 20. The abdomen was tympanitic. White blood count, 4,200; polys, 59 per cent; lymphocytes, 40 per cent; transitionals, 1 per cent. Smears were negative for malarial parasites. Typhoid and paratyphoid were suspected at this time and blood cultures were requested. The patient was questioned regarding the source of food taken outside of the mess halls. According to his statement, he drank milk and ate pork sandwiches on many occasions during the evening. He did not know whether the milk was of the bovine, caprine, or equine variety or whether it had been pasteurized.

Physical examination.—Patient, a white male, aged 19 years, weight 155 pounds, height 70 inches. Fairly well nourished and developed. Eyes, ears, nose, and throat negative. Chest normal in shape. Expansion good and equal on both sides. Heart and lungs negative. Systolic blood pressure, 110; diastolic, 58. Abdomen tympanitic; liver and spleen not enlarged. Glandular and nervous system normal. Feces and urine examination negative.

Progress notes.—Temperature dropped abruptly to normal on evening of admission, but rose to 101° the following evening. During the first 24 hours the patient perspired profusely and to such an extent that the mattress needed changing.

November 23, 1930: White blood count, 5,700; polys, 59 per cent; lymphocytes, 41 per cent. Temperature, 105°; pulse, 98; respiration, 20. No complaints. States that he feels fine. Perspires freely at night.

November 25, 1930: Sputum examination negative for acid-fast organisms. Blood smears negative for malarial parasites. Blood cultures negative. No complaints.

November 30, 1930: White blood count, 7,000; polys, 35 per cent; lymphocytes, 64 per cent; eosinophiles, 1 per cent. States he is feeling fine and would like to get up. Patient is much weaker and restless at night. Agglutination tests for typhoid and paratyphoids were negative, but was positive for undulant fever in a dilution of 1-240.

December 8, 1930: Spleen palpable slightly below costal arch.

December 15, 1930: Temperature subsiding and approaching normal. Has lost considerable weight.

From this date patient improved steadily, and on January 19, 1931, weighed 159 pounds. He was returned to duty after 61 days on the sick list.

This is the history in brief of a type of fever resembling typhoid which was encountered on several occasions. A subsequent case was no doubt caused by the *B. melitensis* var. *abortus*, but due to the inability to obtain a local strain for agglutination purposes a positive agglutination could not be obtained. However, from the history and physical findings the case was one of undulant fever.

CONCLUSIONS

1. Undulant fever exists in China in areas inhabited by naval personnel.
2. Undulant fever should be suspected in cases of protracted fevers resembling typhoid, especially where raw milk is consumed.

RUPTURE OF ANEURYSM OF ABDOMINAL AORTA FROM A SURGICAL VIEWPOINT

REPORT OF TWO CASES

By G. A. ECKERT, Lieutenant Commander, Medical Corps, United States Navy, and
R. E. BAKER, Lieutenant, Medical Corps, United States Navy

Aneurysm of the abdominal aorta is of comparative rarity, but must nevertheless be thought of and eliminated in the diagnosis of an "acute abdomen." The majority of cases terminate fatally by rupture, although death may also occur (according to Matas) by (1) disturbances of peripheral circulation, resulting in gangrene of extremities, gangrene of intestines or other abdominal viscera, or uremia following occlusion of renal arteries (this condition may occur either through clot formation in the aneurysmal sac blocking up the collaterals which supply the stomach, duodenum, liver, and pancreas, or by compression and occlusion of the arteries by the aneurysmal mass); (2) small preliminary extravasations may invade surrounding tissues and bring about death by anemia, exhaustion, or interference with vital organs; (3) marasmus and aneurysmal cachexia; (4) infection and sloughing of the sac with sepsis and secondary hemorrhage; and (5) by the formation of arteriovenous

aneurysms from rupture into the vena cava, bringing about a fatal syncope from acute arterial depletion.

Rupture of aneurysm of the abdominal aorta presents a dramatic picture. There is a steady, agonizing, relentless, abdominal pain which persists until death and is only partially relieved by morphia. Boardlike rigidity of the abdominal musculature is also noted and the abdomen is distended and tympanitic. Expansile pulsation, while theoretically the pathognomonic feature, is sufficiently obscured as to render the diagnosis uncertain. It is more prominent in the commoner type having its origin at the level of the coeliac axis than in that nearer the iliac bifurcation. Rupture of the sac, when it occurs by progressive small retroperitoneal hemorrhages, does not produce immediate syncope and death, but may simulate, over a period of days, many acute surgical conditions, any one of which would require an immediate exploratory operation. Visceral perforation, appendicitis, peritonitis, intestinal obstruction, acute pancreatitis, volvulus, perinephritic abscess, cholelithiasis, nephrolithiasis, and psoas abscess may all be simulated by the extravasations occurring preliminary to the final rupture of an abdominal aneurysm. Syphilis is practically always present in this type of vascular disease, and an alcoholic history is not unusual. Leukocytosis and a low-grade temperature elevation were confusing factors present in both cases reported. X-ray and fluoroscopic examinations are useful in demonstrating vertebral erosion, revealing the status of the gastrointestinal tract and, where the pulsating sac is of sufficient density or where there are calcified atheromatous plaques in the wall of the sac or the intima of the aorta, revealing their size, shape, and location.

Following rupture, blood extravasates throughout all the retroperitoneal tissues and spaces gradually or suddenly, dependent upon the type of rupture. When ruptured during an exploratory operation (as was one of our cases) the ensuing hemorrhage is so sudden and rapid as to be almost impossible to control except by ligation or compression of the aorta, if accessible, and this procedure offers an extremely bad prognosis.

In our second case, at autopsy, there was noted within the sheath of the rectus muscle an extravasation of blood which permeated the muscle substance. It is believed that this was probably due to the rupture of the distended collateral veins (deep epigastric) which were probably overtaxed as a result of compression of the vena cava by retroperitoneal hemorrhage or by the pressure of the neighboring aneurysmal sac, although this is only a conjecture.

The following case reports in brief are submitted for comparison and with the hope that they may assist others in recognizing this condition, with the avoidance of surgical intervention in such cases:

CASE No. 1.—F. H., a sergeant in the United States Marine Corps, age 39 years, was admitted on April 14, 1929, with acute, sudden, and severe epigastric pain, which came on following the exertion of climbing a long flight of stairs. There was no nausea or vomiting, but he was constipated. He gave a history of three months' hospitalization in the Philadelphia Naval Hospital about one year previously and had a definite diagnosis made at that time of aneurysm of the abdominal aorta. During the intervening year he was practically free from symptoms. Had been feeling below par for the past five years, but had attributed it to the effects of tropical duty. Physical examination revealed a broad pulsating mass in the epigastrium which was extremely tender to pressure. There was boardlike rigidity of the abdominal musculature. The epigastric tumor seemed to be expansile to a slight degree. White blood count, 20,000; hemoglobin, 85 per cent. Urine: Shows 2 plus albumin with occasional red cells, a few pus cells in clumps loaded with bacteria. Wassermann test: The fixation of complement was complete (4 plus) with cholesterinized and noncholesterinized antigen. Blood pressure, 80/72. X-ray and fluoroscopic examination shows the anterior portion of the body of the twelfth dorsal vertebra reduced in diameter from above downward and a mass opposite the upper lumbar vertebrae, which extends forward and toward the left. The stomach was displaced toward the left and anteriorly. The mass described pulsates definitely and more to the left.

The pain remained constant, requiring morphia. This continued until the fourth day after admission, when he exhibited even sharper epigastric pain, so severe that he rolled out of bed and soon gave evidence of a lethal hemorrhage. He suddenly sank into profound shock, with subnormal temperature, rapid and feeble pulse, and died.

Autopsy revealed the discoloration about the umbilicus, known as "Cullen's sign" of intraperitoneal hemorrhage. The right flank was more prominent than the left and a sense of firmness was felt as compared with the right. On opening the peritoneum about 400 c. c. of bloody fluid was found in the right flank and pelvis, with some soiling of peritoneum in the left side. There was a mass of blood clot, retroperitoneal and about 2 cm. thick, which covered almost completely the ascending colon. A thin layer of blood clot was spread over portions of the small intestine in lower abdomen. In the epigastrium a large mass pushed forward the body of the pancreas and stomach, so that the epigastric space was level with the thorax. The retroperitoneal tissues of the posterior wall of the pelvis and lower anterior wall were suffused with blood.

Aorta.—The intima throughout its entire length presented numerous atheromatous plaques, slightly raised above the surface, from 0.2 to 1.2 cm. in diameter, and numerous longitudinal striations. At upper portion of abdominal aorta was a large, nearly quadrangular opening, about 3.5 cm. by 3.2 cm., which led into an aneurysmal sac. The sac was heart-shaped, measuring 17.5 cm. by 15.5 cm., with an anteroposterior diameter of 8 cm. At its upper right extremity was a ragged perforation (about 3 cm. by 2 cm.) from which protruded a laminated thrombus. In the margins of the aneurysmal opening in the aorta were the orifices of several aortic branches. The appendix and caecum, ascending and descending colons were removed, and disclosed a bed of blood clot in the right quadrant. The ascending colon was pushed forward by a large extravasation of blood behind it, amounting to at least a liter. The blood was coagulated, dark, and was in the greatest amount in the region of the hepatic flexure and mesially. The massive hemorrhage was the result of rupture of the aneurysm in its right, upper, and posterior portion. The

right adrenal was almost entirely incased in blood clot, and the blood had spread to the left, partly enveloping the left kidney. Just outside the sac at the site of the rent was a round ball of encapsulated blood clot, about $2\frac{1}{2}$ cm. in diameter, evidently an older extravasation than that found in the right flank. In other words, a small leakage had evidently begun a few days previously, resulting in the formation of this well-circumscribed clot at the point of rupture. The liver showed large areas of acute necrosis, probably of anemic origin and due to disease or thrombosis of the hepatic arteries near their origin at the coeliac axis.

CASE No. 2.—W. P., a negro veteran, age 30 years, was admitted April 29, 1931, complaining of severe left-sided abdominal pain, numbness, and pain in left thigh, left lumbar pain, and nausea and vomiting. The patient reclined on his left side with thigh partially flexed, and any effort to extend the thigh resulted in immediate and prolonged exaggeration of the pain. Symptoms began 6 weeks prior to admission, although there was a history of lumbar pain 18 months previous to that. The first indication of trouble was a weakness of the left lower extremity following exertion in connection with the operation of a motor truck. The other symptoms appeared gradually and grew progressively worse. He complained also of lameness of left upper extremity prior to admission, but this improved after massage, and it was believed that this was probably due to the fact that patient was lying on his left side constantly, with resulting interference with nerve function. Physical examination revealed a distended and tympanitic abdomen with boardlike rigidity of abdominal musculature. There was an indurated tumor about $1\frac{1}{2}$ by 2 inches wide, extremely painful and showing a slight pulsation, and extending about 2 inches below Poupart's ligament in the left femoral region. The point of severest pain, as indicated by the patient, was at a point just above the left internal inguinal ring. There was a presystolic murmur over second right interspace and a systolic murmur at apex, transmitted to axilla. Knee jerk absent on left side but present and active on the right. Urine negative. Kahn test, 4 plus. Blood pressure, 160/95. White blood count, 20,000; neutrophils, 87; lymphocytes, 13. Veins of left leg are full, palpable, warmer than right. Hip rotates freely; abduction normal; flexion limited. There is severe back spasm and tenderness above left sacro-iliac joint. X-ray lumbar spine: No pathology apparent in lumbar spine or sacro-iliac region. X-ray dorsal spine: No pathology apparent in dorsal spine.

The patient was admitted to the surgical service after consultation, a diagnosis of psoas abscess having been made.

Operation on May 7, 1931.—Exploratory: Incision about 3 inches long parallel to and near the outer border of left erector spinae muscle between the last rib and the crest of the ilium. The aponeurosis of the erector spinae muscle was divided; the outer edge of the muscle was retracted toward the spine. The quadratus lumborum muscle was divided close to the transverse processes and the psoas muscle exposed. On exploring with the finger around the psoas muscle there was a sudden severe hemorrhage, so severe as to necessitate immediate packing of wound. Patient was returned to bed. The patient grew weaker and exhibited profound shock, and died two hours after the operation.

The autopsy revealed a large aneurysm of the abdominal aorta having its origin just above the bifurcation of the iliac arteries, occupying the posterior left wall of the pelvis and extending downward toward the femoral region. It was of the fusiform type. A large amount of retroperitoneal extravasation of blood was noted, particularly in the left side of the pelvis. On opening the

abdomen there was found within the sheath of the rectus muscle a large jelly-like mass, which resembled a blood clot and which permeated the muscle substance. In the femoral canal there was a mass which appeared to be an organized blood clot. The prevesical space was filled with a blood clot. The autopsy was not extended further.

SUMMARY

(1) Two cases are reported of rupture of aneurysm of the abdominal aorta, with the outstanding clinical features of each.

(2) Steady severe abdominal pain, muscular rigidity, leukocytosis, low-grade fever, abnormal areas of pulsation, and evidence of lues were present in both cases.

(3) Exploratory operations were considered in consultation in both cases due to the simulation by each of acute surgical conditions, and operation was performed in one case with unfortunate results.

REFERENCES

Rudolph Matas: Surgery of the Vascular System—Keen's Surgery. Vol 5: 1909.

Da Costa: Modern Surgery, 1926.

PSEUDO-ELEPHANTIASIS OF THE SCROTUM

REPORT OF A CASE

By J. A. TOPPER, Lieutenant, Medical Corps, United States Navy, and R. E. BAKER, Lieutenant, Medical Corps, United States Navy

Various textbooks on urology and surgery mention the condition of spurious or pseudo-elephantiasis only briefly in comparison with the more extensive discussions on true elephantiasis, or that produced by the *Filaria bancrofti*. However, it seems to be the general consensus of opinion that there is such a condition and that it is an hypertrophy of the skin and subcutaneous tissues due to chronic inflammation or cicatrization which creates obstruction of the normal lymphatic flow. This latter is regarded by practically all writers as an essential factor and has led to the term "lymph scrotum" being used by many to designate the enlargement of the scrotum which may occur in filarial disease as well as the "pseudo" type due to non-filarial obstruction.

Among the causes of pseudo-elephantiasis are mentioned inguinal adenectomy, pyogenic infection, traumatism, syphilis, tuberculosis, leprosy, erysipelas, granuloma inguinale, and infective lymphangitis.

Pseudo-elephantiasis differs from the elephantiasis only in the manner in which the lymphatic channels are obstructed, the presence

or absence of filaria, and the history of the case establishing the diagnosis.

A benign hyperplasia of the scrotal skin and subcutaneous tissues takes place following the stasis of lymph in the intercellular spaces, with the resulting deposition of large masses of fibrous tissue. The scrotum is hard, dense, and does not pit on pressure. Folds and fissures are apt to form in the skin, particularly on the inferior surface of the scrotum, and warty excrescences are usually found.

The principal symptoms are the inconvenience of weight, unsightliness, difficulty in walking, and interference with normal urinary and sexual functions.

The following case is definitely one of nonfilarial elephantiasis in spite of the fact that he has spent a large part of his life in the Southern States, as blood smears have been repeatedly negative for *Filaria bancrofti*, and the etiologic factors disclosed in his history are quite adequate to explain the pathology found. The urethral stricture and probable rupture of urethra by instrumentation followed by urinary scrotal fistula and infiltration, plus the added factor of luetic infection, would certainly account for a great deal of chronic inflammation, cicatrization, and lymphatic obstruction.

H. B., a 42-year-old negro male, admitted with a history of gonorrhea at 33 years of age, followed by stricture of urethra. An unsuccessful attempt was made about three years ago to pass sounds, and this was followed by profuse urethral hemorrhage. Two years ago he first noticed the scrotum beginning to enlarge. A urinary fistula then developed at the lower pendulous portion of the scrotum. It reached its present size in about six months' time. Sexual desire and power lost. Scrotal operation about one year and a half ago was unsuccessful in reducing the size of the tumor.

Patient has spent most of his life in western part of Florida. Physical examination negative except for bilateral cataract, with loss of vision in right eye and evidence of slight right-sided facial paralysis and greatly enlarged scrotum, the inferior surface of which was fissured and moist from urine seepage through fissures. Scrotum is about 10 inches in diameter, and dense and firm in consistency. There are two linear scars parallel with the base of the penis and on either side of same. Kahn test, 3 plus.

A suprapubic cystotomy was done, using the "A" incision through skin and superficial tissues as described by Lowsley. Rectus split and bladder opened on dome. Suprapubic drain of rubber sewed in bladder and muscles closed with chromic catgut, and skin sutured with silkworm gut.

One month after this operation a second operation was done, as follows: Removal of scrotal tumor; perineal urethrotomy; retrograde passage of catheter. Incision in median raphe from forward of rectum to base of penis. Mass of fibrous tissues size of pumpkin excised. Right testis removed. Urethra dissected free, opened, and mushroom catheter inserted to bladder. Spinal and ether anesthesia.

Four weeks after the second operation the suprapubic opening had healed. The penile urethra functioned well after removal of

catheter. Patient gained in weight and strength, and soon noticed the return of sexual vigor and desire.

We wish to acknowledge our indebtedness to Lieut. Commander G. A. Eckert, Medical Corps, United States Navy, for his generous advice and assistance.

REFERENCES

Breene, L. W., and Zur Linden, W.: Elephantiasis of the scrotum. U. S. N. Med. Bull. 15: 834, July, 1921.

Stenhouse, H. M.: The real cause of elephantiasis. U. S. N. Med. Bull. 22: 119, February, 1925.

Williams, L. H.: Multiple scrotal fistulae following rupture of the bladder with stricture of urethra—operation and restoration of function. U. S. N. Med. Bull. 25: 897, October, 1927.

Bertwistle, A. P., and Gregg, A. L.: Elephantiasis. Brit. J. Surg. 16: 267, October, 1928.

Bickham: Operative Surgery. 1924, vol. 5, p. 799.

Cabot: Modern Urology. 1918, Vol. I, p. 457.

Young: Practice of Urology. 1926, vol. 2, p. 570.

White and Martin: Genito-Urinary Surgery and Venereal Diseases. 1917, p. 295.

Chetwood: Practice of Urology. 1916, p. 300.

RECURRENT SUBLUXATION OF THE HEAD OF THE HUMERUS FROM MUSCULAR ATROPHY

A CASE REPORT

By DENIS S. O'CONNOR, M. D., F. A. C. S., Lieutenant, Medical Corps, United States Naval Reserve

The case reported herewith was essentially a case of injury to the cervical spine with nerve root involvement which was unrecognized. The recurrent subluxation of the head of the humerus was the result of the subsequent muscular atrophy. The essential nature of the condition was not recognized until some months after full recovery had taken place.

An enlisted man in the United States Navy, of heavy muscular build and an outstanding player on one of the battleship football teams, was troubled by a condition of the right shoulder characterized by sudden pain in the shoulder when the right arm was abducted 90° and externally rotated. The sudden severe pain caused immediate disability, which was relieved sometimes spontaneously and at other times by traction on the arm of the affected side. Radiographs were negative for bone or joint lesions. The patient was examined about eight months after the trouble because of the fear that the condition would become troublesome in the next football season. The shoulder was absolutely negative in all respects. Realizing the

frequent relationship between cervical spine lesions and shoulder pain, the cervical spine was examined and found to have definite limitation of motion on bending to the left and on rotation to the left. On interrogation of the patient it was brought out that during the time in which the shoulder dysfunction was present the size of the right arm and shoulder was greatly reduced in comparison with the left side. Further investigation brought out the fact that preceding the onset of symptoms the patient had fallen on the back of the neck and shoulders in such a way as to forcibly flex the head on the body. New radiographs, which were taken at this time, were not viewed, but were said to be negative.

The explanation of the shoulder symptoms was simple. The shoulder joint itself was normal. Muscular atrophy of the muscles of the right shoulder and arm, secondary to temporary damage to the nerve roots of the right brachial plexus, when the head was violently and forcibly flexed, allowed the head of the humerus to hang away from the glenoid cavity. In abducting and externally rotating the arm the head of the humerus rode up on the anterior edge of the glenoid cavity, but did not dislocate completely because of an intact capsule. The pain associated with the subluxation was caused by the stretching of the brachial plexus nerve trunks and the sudden and complete relief of the disability was affected by the return of the head of the humerus to the glenoid cavity.

The relationship of cervical spine lesions and shoulder pain should always be borne in mind, and a shoulder examination should not be considered complete without at least a casual examination of the cervical spine.

NAVAL RESERVE

APPOINTMENTS, SECOND QUARTER, 1931

Name	Rank	Appointed
Bubert, Howard M.....	Lieutenant (junior grade), MC-V (G).....	May 26, 1931
Collins, Conrad G.....	do.....	June 2, 1931
Duff, Alexander M., Jr.....	do.....	Mar. 23, 1931
Hickey, Harold L.....	Lieutenant, MC-V (S).....	Mar. 30, 1931
Hunt, Jasper S.....	Lieutenant (junior grade), MC-V (G).....	May 27, 1931
Menville, John G.....	do.....	Mar. 12, 1931
Neill, William A.....	Lieutenant commander, MC-V (S).....	May 9, 1931
Pendleton, Ralph C.....	Lieutenant, MC-V (S).....	Mar. 24, 1931
Schaller, Walter F.....	Lieutenant commander, MC-V (S).....	Apr. 27, 1931
Stevens, George A.....	Lieutenant (junior grade), MC-V (G).....	May 12, 1931
Tibbets, Lyman B.....	Lieutenant, MC-V (S).....	Apr. 27, 1931
Welsh, Thomas F.....	Lieutenant (junior grade), MC-V (S).....	May 18, 1931

PROMOTIONS

Name	From—	To—
Davis, William J. N..	Lieutenant (junior grade), MC-V (G).....	Lieutenant, MC-V (G).
Day, William D. C...	do.....	Do.
Holcomb, William F..	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.
King, W. Ivan.....	Lieutenant, MC-V (G).....	Lieutenant commander, MC-V (G).
Kretzler, Harry H....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.

NOTES AND COMMENTS

ORGANIZATION OF THE BUREAU OF MEDICINE AND SURGERY

The following is an outline of the new organization of the Bureau of Medicine and Surgery, showing the activities of the various divisions of the bureau, which became effective June 5, 1931.

CHIEF OF BUREAU

ASSISTANT TO BUREAU

CHIEF CLERK

DIVISION OF ADMINISTRATION

Office of Chief Clerk.—Legislation, laws, and regulations—General administrative matters—Civilian employees, bureau and field—Bureau maintenance.

Mail and Files Section.—Receipt, keying, routing, indexing, and filing of mail—Care of outgoing mail—Mailing lists.

Claims Section.—Adjudication of claims for medical, hospital, dental, and funeral expenses—Professional treatment from civilian sources.

Section of Care of the Dead.—Care, transportation, and burial of the dead—Cemeteries, headstones, contracts, laws, regulations, and associated matters.

DIVISION OF PERSONNEL

Medical Corps Section.—Appointments—Complements—Assignments—Duties—Instruction.

Hospital Corps Section.—Complements—Enlistments—Assignments—Instruction—Duties—Professional competency.

Nurse Corps Section.—Complements—Appointments—Assignments—Instruction—Duties.

Reserve Section.—Medical Corps, Dental Corps, Hospital Corps, Nurse Corps—Enrollment, instruction, etc.

DIVISION OF RED CROSS AND VETERANS' ADMINISTRATION

Red Cross Section.—Bureau of Naval Affairs, American Red Cross—Social service for enlisted personnel and dependents.

Section of Veterans' Administration.—Bed capacities—Veterans' Bureau patient personnel census—Federal Board of Hospitalization matters—Complaints—General liaison.

DIVISION OF PLANNING

Study of basic war plans—Preparation of bureau contributory plans—Navy Munitions Board—Medical Committee of Joint Board—Secret and confidential correspondence and publications.

DIVISION OF PUBLICATIONS

Editing and publishing of Annual Report of Surgeon General—Naval Medical Bulletin—Manual of the Medical Department—Supply Tables—Handbook for Hospital Corps, etc.—Revision of Navy Regulations, bureau manuals, etc.—Preparation of special articles.

DIVISION OF DENTISTRY

Material Section.—Dental outfits, equipment, and material—Specifications.

Inspection Section.—General inspection of dental department activities.

Professional Treatment Section.—Administration of dental treatment to the naval services—Authorization of dental prosthesis at naval activities and from civilian sources.

Personnel Section.—Appointment—Assignment—Complements—Instruction—Duties—Dental Corps Reserve.

DIVISION OF PHYSICAL QUALIFICATIONS

Physical Qualification Section.—Physical qualifications for appointment, enlistment, promotion, etc.—Retiring boards, medical surveys, annual physical examinations, etc.

Veterans' and Pensioners' Section.—Preparation of medical history data and abstracts for public and private use.

Medical Record Files Section.—Distribution of incoming mail—Indexing and filing—Death certificates, death gratuity, etc.

DIVISION OF INSPECTIONS

Inspection Section.—General inspection of Medical Department shore activities—Annual and inspection reports—Coordination with inspector, west coast.

Public Works Section.—Repairs—New construction—Alterations—Permanent equipment—Utilities.

Ship Plans Section.—Location and design of Medical Department spaces; alterations, equipment, etc.

DIVISION OF PREVENTIVE MEDICINE

Section of Epidemiology.—Control of communicable diseases—Prophylactic vaccines and sera—Quarantine and disinfection; isolation, etc.

Section of Hygiene and Sanitation.—Hygiene and sanitation of ships and shore stations—Occupational diseases—Food, clothing, housing problems, etc.

Vital statistics.—Collection, compilation, analysis, and presentation of vital statistics.

DIVISION OF AVIATION MEDICINE

Physical Qualifications Section.—Physical examinations for flying—General qualifications of different classes of applicants for flight training.

Research Section.—Research in aviation medicine and related problems—Correlation of statistics on aviation accidents—Study of physical qualifications of flight personnel.

DIVISION OF MATERIAL AND FINANCE

Budget Section.—Administration of appropriations and Naval Hospital fund—Estimates, allocations, budget laws, regulations, etc.

Accounting Section.—Financial reports and statements—Receipts, credits, charges, reimbursements—Auditing and cost accounting.

Material Section.—Requisitions for supplies, equipment, and services—Transfers; surveys; records of Medical Department property—Specifications.

THE NAVAL DISPENSARY

Treatment.—Dispensary and out-patient, of officers, enlisted men, and dependents—Physician to House of Representatives—First aid to injured civilian employees.

Physical examinations.—Annual physical examinations—Midshipmen, preliminary and final—State Department candidates—Foreign service, Department of Commerce—Civil service.

THE NAVAL MEDICAL SCHOOL

Medical and Surgical Department.—Postgraduate instruction: At school, at hospitals, at civilian institutions—Requirements of the service as to specialists—Consultations; study of obscure conditions—Laboratories—Library—Examining boards—Special physical examinations.

Dental Department.—Postgraduate instruction—Oral and operative surgery—Denture construction; prosthetic dentistry; technical assistance.

Research Section.—Chemical warfare—Submarine service—Field service—Air service—Special problems.

SPECIALIZATION IN THE MEDICAL CORPS OF THE NAVY

Specialization by naval medical officers has been a topic for a number of articles published in the Naval Medical Bulletin and other military-medical journals.

In the April, 1931, number of the Journal of the Royal Naval Medical Service there appeared a discussion of this interesting subject by Surg. Capt. Sheldon F. Dudley, R. N., under the heading of Some Aspects of Specialization and Research in the Services, from which the following paragraphs are quoted:

* * * It is becoming more and more obvious that no one man can master more than a fraction of the accumulated knowledge, or have time to acquire the technical ability necessary for the efficient practice of more than one or two of the numerous subdivisions of applied medical science. Specialization or division of labor solves the problem to some extent. And the time seems near when the general practitioner will be the most important specialist of all, with the chief function of informing patients to which experts to go. To perform this duty adequately he will require a far wider knowledge than anyone who specializes on a single organ of the body. This may be feasible ashore in areas where the population can support a team of medical men, but in the services the all-round medical man is still required, especially in ships and isolated districts with small populations.

* * * In certain subjects early specialization seems actually to induce pride in ignorance of general medicine and surgery. The following episode illustrates such a tendency, which should always be discouraged while the subject's mind is still plastic enough to receive impressions. At one of the naval hospitals early in the war, a recently qualified youngster who had begun to specialize, joined up as a temporary surgeon lieutenant. He was rightly made specialist in his own subject, but, in accordance with an excellent naval custom, he was also expected to do some general duties and keep days on. Learning this, he "fell in" to see the principal medical officer, to whom he explained that it was dangerous for him to keep a day on, as he might miss an "acute abdomen" or a case of infectious disease—because he was a "specialist." Much to his colleagues' disgust, he got away with it, and was relieved from days on. I may add that if I had been P. M. O. he would have kept days on and stopped on, under his general practitioner colleagues, until he felt that he could spot appendicitis or mumps with the degree of certainty required of the general practitioner. These little failings can be winked at ashore, where a much greater subdivision of labor is possible and desirable than at sea, but they need not be encouraged in the services, where, under the close conditions of living, they are less tolerable. In the navy there is not the work for many whole-time specialists, because there are not enough special cases. Therefore we can avoid the narrowing effect of specialization, while retaining much of its usefulness, by refusing to let medical officers specialize officially before attaining their "half stripe" and sticking to the excellent custom of making specialist medical officers keep *au fait* with general medicine, and with administrative duties. Another excellent naval custom, which I hope will never be

dropped, is that all surgeon commanders should serve a commission at sea before further promotion. Among certain naval medical specialists and bureaucrats I know this custom is unpopular; but for the good of the service and senior 3-stripe officers themselves, I hope the rule will continue to be rigorously enforced, especially with regard to those officers who specialize in administration. Many hospital doctors and administrators who have been long ashore forget how rapidly the navy has changed and is changing, and many also seem to forget, or perhaps never knew, that they are the servants of a seagoing Royal Navy. *The specialist the Royal Navy wants is a man with at least the average knowledge of general medicine and surgery with an extra training in some speciality in addition thereto, but not in lieu thereof.* * * *

* * * The man with a special bent for research will find plenty of scope for his activities, not only in well-equipped laboratories at the base hospitals ashore, but also in the spacious dispensaries of a modern ship of war, where a man good at devising makeshifts can, if he will, carry out academic laboratory and biological investigations at sea. But this is not the only work I include under research or progressive medicine. The services offer an ideal field for medico-statistical investigations, for clinical, as opposed to laboratory, research, and for the study of epidemiological problems. Again, there is room for much research in "administration." Also there are still many interesting problems to solve as regards the food, clothing, work, and last, but not least, the psychology of the sailor. Thus progressive medical work in the services is of a variety to suit anybody's fancy. Except when he is undertaking an investigation by order, the service researcher is in an enviable position: he works to amuse himself only; he can choose his subject, do as much or little as he likes; it does not matter if, as often is the case, his work leads nowhere. He can publish or not, but if he thinks his results of service interest, there are his own journals grateful for copy. * * *

Naval medical officers will find a comparison of the views of Surgeon Captain Dudley with those of members of our own corps very interesting and are referred to the following articles: *The Advisability and Practicability of Specialists in the Medical Corps of the Navy*, by N. J. Blackwood, captain, Medical Corps, United States Navy, *The Military Surgeon*, February, 1915; *Specialism in the Navy Medical Corps—A Review*, by N. J. Blackwood, captain, Medical Corps, United States Navy, *United States Naval Medical Bulletin*, July, 1926; and *Specialization in the Navy*, by H. W. Smith, captain, Medical Corps, United States Navy, *United States Naval Medical Bulletin*, July–October, 1929.

NAVAL MEDICAL OFFICER ASSIGNED TO GORGAS MEMORIAL INSTITUTE

The Medical Corps of the United States Navy has been intimately associated with the Gorgas Memorial Institute of Tropical and Preventive Medicine from the time the institute was incorporated in 1921.

Rear Admiral W. C. Braisted, Medical Corps, United States Navy (retired) was the first president. This position is now held by Rear Admiral C. T. Grayson, Medical Corps, United States Navy (retired).

Rear Admiral Charles E. Riggs, Surgeon General, United States Navy, is a member of the board of directors.

Rear Admiral E. R. Stitt, Medical Corps, United States Navy (retired), was a member of the original board of scientific directors. His place on this board is now occupied by Capt. C. S. Butler, Medical Corps, United States Navy.

This memorial, according to Dr. Franklin Martin, who has been most active in furthering the interests of the institute, is "the tribute of the nations to William Crawford Gorgas—the establishing of a memorial not of stone or bronze, but a living vital organization which embodies the hope of freeing all the world from disease, the object to which the life of Gorgas was consecrated."

The objects for which the Gorgas Memorial was incorporated cover a wider field than is generally known, viz:

"To conduct, assist, and encourage investigations in the sciences and arts of hygiene, medicine and surgery, and allied subjects, in the nature and causes of disease and the methods of its prevention and treatment, and to make knowledge relating to these various subjects available for the protection of the health of the public and the improved treatment of disease and injury, particularly as applied to tropical and preventive medicine. It shall be within the purposes of this corporation to use any means to these ends which from time to time shall seem to it expedient, including research, publication, education, the establishment and maintenance of charitable or benevolent activities, agencies, or institutions appropriate thereto, and the aid of any other such activities, agencies, or institutions already established or which may hereafter be established."

In 1928 funds became available, by an act of Congress, for the maintenance and operation of the Gorgas Memorial Laboratory, which would serve for the initial work of the institute. The Government of Panama authorized the use of a building on the grounds of the Santa Tomas Hospital, in Panama.

"Among the paramount problems for early consideration by the laboratory will be malaria, which is of so much interest, not only to the scientific medical profession and sanitarians, but as well to the people and industries of all tropical and semitropical countries, and to at least one-half of the territory of the United States."

From the beginning it has been the intention of the Navy, the Army, and the Public Health Service to assign qualified medical officers to this laboratory for research work.

Lieut. Commander Paul W. Wilson, Medical Corps, United States Navy, has been detailed on account of his experience with tropical diseases.

The United States Public Health Service has selected W. H. W. Komp, medical biologist, and an experienced sanitary engineer.

The Army is represented by Lieut. Col. H. C. Clark, Medical Reserve Corps, United States Army (formerly of the United Fruit Co.), who was appointed director of the Gorgas Laboratory in 1929.

NAVAL MEDICAL SCHOOL TERM LENGTHENED

The work at naval hospitals and at other naval medical units is usually so increased in volume during January and February that much difficulty has been experienced in finding a sufficient number of medical officers available to form a class of desirable size for the spring term of the Naval Medical School.

For this reason, and also because of the increasing scope of the curriculum at both dental and medical departments of the school, there will now be one class each year, the term beginning in September and extended to eight months.

BISMUTH IN TREATMENT OF SYPHILIS

In view of the increasing use of bismuth in the treatment of syphilis in the Navy, the following views, from an article by Cole, Moore, O'Leary, Parran, Stokes, and Wile, which appeared in the April 20, 1931, number of the Veneral Disease Information, will prove of interest:

The same problem arises with bismuth preparations that we had before us for years with mercury salts. To-day the practitioner knows pretty well what type of mercury remedies to use. The same is unfortunately not yet worked out for bismuth.

Many years will elapse before we shall be in a position to evaluate bismuth compounds in such a manner as we have mercury preparations. Nevertheless, after some 10 years or more of using bismuth salts, in an intensive manner, in the treatment of syphilis, we may be able to form some conclusions as to the better types of bismuth salts to be used, as to the preferable route for attack, and as to the results of therapy, both good and bad.

It is suggested that in choosing a bismuth salt for injection, from the numerous preparations on the market, it would be well to choose with the following points in mind:

It should give rapid absorption from the injection focus, and yet not so rapid but that there will be an appreciable afterperiod of absorption lasting for at least some days or even a week or more. The preparation should be capable of exact dosage. It should not be painful, nor should it conduce to troublesome later local abscess formation. The ideal bismuth preparation must also show from its excretion curve of metallic bismuth from the feces and urine that not only is the drug being absorbed, but that while some is stored in the system a certain appreciable level of bismuth is circulating continuously in the blood stream and is being excreted. Naturally, through it all, a good preparation should give good clinical results. Just how much bismuth it should require to answer these requirements is difficult to say, but probably such a preparation

should contain anywhere from 3 centigrams to even 2 decigrams metallic bismuth to a dose, and possibly a course of therapy lasting 8 to 10 weeks should amount to from 6 decigrams to 2 grams of metallic bismuth. The question has also been brought up here, as with mercury, that perhaps it is not the total metallic bismuth that counts as much as possibly the ionizable bismuth.

* * * The use of liposoluble preparations seems to be spreading throughout Europe. Clement Simon well summarizes the situation in a recent article in the Bulletin Médical (Paris). For him the liposoluble bismuth salts combine the advantages of the water-soluble bismuth preparations and of the insoluble bismuth salts—rapidity of action of the first and prolonged action of the latter. They are less irritating to the organism than the water soluble salts, and they do not form the intramuscular depots like the insoluble salts. When symptoms of irritation or intoxication appear, they disappear more rapidly than with the insoluble salts. They constitute a happy medium between the preparations known up to this time, and merit first rank.

The fact remains, however, that as yet sufficient excretion studies have not been made on these preparations to really evaluate their correct place in the treatment of syphilis. If it be true that with them one gets a high bismuth excretion persisting over a period of several days, then well and good. If, on the other hand, the excretion drops within 24 hours, then we have a preparation no better than the water-soluble sodium bismuth citrate, or the bismuth thloglycollate, or the sodium bismuth tartrate. This question should be solved as soon as possible. In the meantime we can still stand on our insoluble suspensions in oil of the potassium bismuth tartrate and of the tartroquinobine and of the salicylates and of the subsalicylates. Time only can finally satisfy us as to the best bismuth salts and as to the real place of bismuth in syphilis therapy.

As to the modes of employment, intramuscular injections have given the best results. Attempts to use bismuth by the inunction route or by mouth have been unsuccessful. Intravenously, bismuth is ten times as toxic as by the intramuscular method, and the Council on Pharmacy and Chemistry has for the present advised against this type of administration.

The value of bismuth as a prophylactic, they believe, has not been proven.

In connection with the results of bismuth therapy it is stated that certainly in primary syphilis one can cause the disappearance of the *Treponema pallidum* in a chancre "with various bismuth preparations in a space of from one or two to four or five days. Probably the results are not as rapid as with the arsphenamins; nevertheless they are very good. This would be one of the places where water-soluble bismuth salts could well be employed in injections every two or three days for a period, provided, of course, there was a contra-indication to arsphenamin."

* * * After all, arsphenamin is the remedy of choice for attack in a fresh syphilis; later bismuth and mercury can be used. As we go on to secondary syphilis we find bismuth again to be a very valuable agent, though hardly to be used to the exclusion of arsphenamin. We have felt for some time, and still contend, that syphilis is not a disease, if there is no contra-

indication, to be attacked by any one remedy to the exclusion of other valuable agents. * * *

* * * In late syphilis, or tertiary syphilis, showing little or no ravages as far as physical examination is concerned, we are more and more relying on bismuth, potassium iodide, and mercury. Why take the risk of arsenicals if they be not required? The same applies to syphilis in old people, though here the bismuth, as with all heavy metals, must be used in moderate-sized doses. It is difficult to sterilize these cases, but bismuth does nicely in keeping the disease in check.

Bismuth also has a definite place in the therapy of congenital syphilis. Most intramuscular mercury injections are poorly withstood by the infant or young child, while, on the other hand, bismuth preparations are well borne. * * *

In central nervous system syphilis bismuth also has its place. We question whether it will give better results than the arsenicals, but, again, it is very convenient to have still another remedy to which we can turn. * * *

Among the deleterious effects of bismuth therapy are mentioned the thin violaceous gray line on the gums as the most common symptom; rarely there may be a stomatitis; occasionally vague loss of ambition, asthenia, and what is termed "bismuth grip." Of the cutaneous symptoms, now and then one encounters pruritis, urticaria, erythema, or even a generalized exfoliative dermatitis. Purpuric eruptions have been rare.

Jaundice has been reported, but bismuth is more liable to affect the kidney; therefore, the urine of patients under treatment should be constantly watched.

"Of the local symptoms seen from bismuth injections, one notes occasionally local indurated painful masses lasting for a few days or a week. Rarely there is a late profound sterile abscess which must either be opened or will open itself spontaneously. By mistake, though not in technic necessarily, we occasionally inject a bismuth preparation into a vein in the buttock, resulting in an embolus. This can usually be avoided by the pulling back on the plunger of the syringe after the needle and syringe are in place. * * *"

CONTROVERSIES ON YAWS—SYPHILIS RELATIONSHIP AND ORIGIN OF SYPHILIS

The Lancet has published in several recent issues a series of letters to the editor regarding two subjects which have long served as points of rather heated controversy.

It is not surprising to naval medical officers to find Capt. C. S. Butler, Medical Corps, United States Navy, widely known for his firm stand and very decided views on these subjects, one of the principals in the controversy.

He and one other of the correspondents have been driven to poetical and other forms of literary flight for the expression of

the high feeling that is attached to their opinions, and this element in the correspondence has added measurably to the zest of the game.

The first letter, by Captain Butler, appeared in the *Lancet* of April 25, 1931. It is quoted here in full:

TO THE EDITOR OF THE *LANCET*.

Truth, crushed to earth, shall rise again;
Th' eternal years of God are hers;
But Error, wounded, writhes in pain,
And dies among his worshippers.

(BRYANT, *The Battle Field*, st. 9.)

SIR: The first two lines of the above stanza are doubtless true. William Cullen Bryant was wrong, however, in the two last lines of his verse, because error crushed to earth will do the same thing as the poet found truth would do—it will rise again. Some medical errors seem not to do much “writhing” among their worshipers either. Many are hoary with age, and yet physicians are perpetuating them to-day in both popular and professional literature. In other words, physicians are the chief worshipers of these errors.

The ancient European ancestry of syphilis may be shown in a dozen ways, direct and indirect, and yet we find in current literature physicians subscribing to the moth-eaten fallacy that syphilis is of New World origin. So, too, with the yaws fallacy. Since the time of Sydenham and long before him there have been English and continental physicians who “thought and taught” correctly about framboesia. Berkeley Hill of English and E. Lancereaux of French physicians, both of the third quarter of the nineteenth century, have shown how completely the yaws syndrome is identified with syphilis. The researches of these older writers have been backed up by clinical, epidemiological, and laboratory researches without number. On the other hand, research workers during the past 40 years trying to prove the theory of duality of viruses have failed, so that to-day it is possible to say that yaws is purely an artefact erected over the disease syphilis. This statement is made with the hope that some dualist will produce evidence to the contrary. There has been ample time for all such evidence to assert itself.

The yaws fallacy has persisted in medical literature for 200 years almost, and is so far advanced that practically all English, continental, and American textbooks on tropical medicine give it extensive description. This is due largely to the “library case” made out for yaws and to the repetition from volume to volume and edition to edition of the ever-growing fallacy, thus completing the vicious circle between teacher and student. Recalling the fate of Socrates in similar case, we may well feel that some fallacies of the “Guild of Aesculapius” are virtually immortal and that truth when crushed to earth often takes centuries “to rise again.”

I am, sir, yours faithfully,

C. S. BUTLER,

Captain (M. C.), United States Navy.

WASHINGTON, D. C., April 8, 1931.

This letter stirred Hugh Stannus Stannus, a noted British authority in tropical medicine, to reply in the *Lancet* of May 2, 1931, as follows:

To the EDITOR OF THE LANCET.

SIR: The relationship of syphilis and yaws presents a problem of the greatest interest to those who have studied the latter disease, but one to which the majority of your readers may have given little thought. Captain Butler in your last issue animadvertes upon the common facts that many statements are repeated in medical literature which are not true or which are no longer accepted by the bulk of medical opinion. Among these he would place the view that yaws and syphilis are separate disease entities, and he boldly exclaims "to-day it is possible to say that yaws is purely an artefact erected over the disease syphilis. This statement is made with the hope that some 'dualist' will produce evidence to the contrary. There has been ample time for all such evidence to assert itself." He points out that "since the time of Sydenham and long before him there have been English and continental observers who thought and taught correctly about framboesia. Berkeley Hill of English and E. Lancereaux of French physicians have shown how completely the yaws syndrome is identified with syphilis." I can not help thinking that Captain Butler has been most unhappy in drawing inspiration from these two writers. Both wrote treatises upon syphilis, but neither had any first-hand knowledge of yaws, and in respect of this disease are guilty of that same fault in their writings of which Captain Butler complains. Their opinions were based upon the writings of others (Paulet, for example), which they failed to interpret correctly. Their opinions upon yaws are absolutely valueless, as will be apparent to anyone conversant with the older writers on framboesia. Lancereaux was not even aware that the words "plan" and "yaws" referred to the same lesion, and Hill says of sibiens (a nonvenereal epidemic syphilis) that it much resembles yaws, a statement which is quite untrue.

Not very much has actually been written upon the unity or duality of these two diseases, but (without entering the ranks of the dualists to cross swords with Captain Butler) I think it should be stated, lest Captain Butler's statement be given undue credence, that, for the majority of those able to judge, yaws as a disease entity has appeared to withstand the onslaught of Captain Butler and others who hold opinions similar to his own. I think, moreover, that the dualists might quite fairly take up the opposite stand and express the view that the onus lay with Captain Butler to prove them wrong. As a non-partisan onlooker and without attempting to open a discussion, I imagine he would be required to explain why no single case of absolutely undoubted syphilis has ever exhibited the typical pathognomonic florid eruption characteristic of yaws vouched for by an authority on framboesia.

I am, sir, yours faithfully,

HUGH STANNUS STANNUS.

WIMPOLE STREET, W., April 25, 1931.

While Captain Butler was writing his reply to the Stannus letter, E. Tytler Burke, another British authority, showed his disagreement with both Stannus and Butler in a letter published in the Lancet of May 16, 1931:

To the EDITOR OF THE LANCET.

The faintest streak that on a petal lies
May speak instruction to initiate eyes.

(BRYANT, The Mystery of Flowers.)

SIR: Captain Butler, of the United States Navy, heads his letter in the Lancet for April 25 with a quotation from William Cullen Bryant. I have

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followed his example; and I imply by my quotation, of course, that if Captain Butler has seen the streak on the petals of syphilis and yaws his eye is not sufficiently initiate to appreciate the instruction available.

His communication amounts to this, that in his belief syphilis did not originate in America, and also that syphilis and yaws are one and the same disease. I am tempted to indicate briefly certain things which show that syphilis has not a European ancestry, and also that it and yaws are separate and distinct disease entities.

Although Captain Butler says that "the ancient European ancestry of syphilis may be shown in a dozen ways, direct and indirect, and yet we find in current literature physicians subscribing to the moth-eaten fallacy that syphilis is of New World origin," nevertheless he fails to mention one single way. If syphilis existed in the Old World prior to 1493, then all he has to do is to produce one reference to it before that date. He has only to cite one case of congenital syphilis, one case of tabes, one case of paresis, or one pre-Columbian syphilitic bone. But that, of course, he is quite unable to do.

Before the return of Columbus, all is silent upon the subject of syphilis. But shortly thereafter the new disease under divers names resounds throughout Europe, causing consternation and dismay. It behaves as a new disease, spreads as a new disease, and is recognized by contemporary physicians as a new disease. Nay, more, it is immediately shown to have been introduced by the returned crews of Columbus, some of the men being infected—including the pilot, Pinzon—when they arrived in Palos on that fateful Ides of March. Las Casas and Oviedo, among others who visited the New World soon after, showed that the disease had been prevalent among the natives of America from time immemorial.

I am writing with a full knowledge of the joint paper by Captain Butler and Lieutenant Hernandez in the Southern Medical Journal (vol. xxii, December, 1929); and here I would like to correct them upon one point. They state that there were no Spanish troops in the French army of Charles VIII which carried out the invasion of the Kingdom of Naples. This is not correct. If they will read the first book of Ruy Diaz de Isla, they will find the following words: "And afterwards in the following year, 1494, the Most Christian King Charles of France, who then was reigning, having gathered a great army, passed into Italy. And at the time he entered the country with his host, many Spaniards infected with the disease were in it. * * *"

Of the duality of syphilis and yaws there is ample evidence. Of their unity there is none. It is true that morphologically the parasite of yaws resembles that of syphilis. It is their different *behaviour* which matters. So with the *Treponema pallidum* and the *Treponema pertenue*. One behaves in a different way to the other. Yaws does not exist in a congenital form—i. e., the child does not acquire the infection in utero. In contrast with syphilis the primary lesion of yaws is seldom genital, and it is usually preceded by marked constitutional symptoms. Endarteritis is absent in yaws, whereas it is characteristic of syphilis. In yaws there is little or no adenitis, the type of exanthem is single, there is great itching, alopecia is absent, and so likewise is iritis. From a yaws-infected mother no child is born who develops notched teeth, interstitial keratitis, eighth nerve deafness, oral fissures, or saddle nose. Yaws and syphilis often coexist in the same person. The one disease does not confer immunity against the other. Yaws does not give rise to tabes, paresis, or aortic aneurysm.

I have just read the letter of Doctor Stannus in the Lancet for May 2, and I am inclined to differ from him in what he says with regard to sibs—

namely, that it is a "nonvenereal epidemic syphilis." I rather regard it as being a European type of yaws. With respect to the remainder of his letter I agree.

In conclusion, I would point out that it would not be valid for Captain Butler to argue the European antiquity of syphilis by showing that yaws—framboesia, sabbens—was known in the Old World before the discovery of America, without first proving that yaws is syphilis. He must avoid the fallacy of *petitio principii*.

I am, sir, yours faithfully,

E. TYTLEB BURKE.

MUNICIPAL CLINIC, REGENT ROAD, SALFORD, May 8, 1931.

In the *Lancet* of May 23, 1931, Doctor Stannus replied to the letter of Doctor Burke as follows:

To the EDITOR OF THE LANCET.

SIR: I feel that the myth about sabbens should be stamped out. Doctor Burke's expression in his letter of May 16 referring to sabbens, "I rather regard it as being a European type of yaws," is perhaps sufficiently damning in its faint praise of the idea that this disease, which occurred in Scotland and was described in 1765, was yaws. Anyone who will read the *whole* of the literature upon sabbens and who is conversant with the accounts of the epidemics of non-venereal syphilis which occurred elsewhere (Mal de Sainte Euphemie, 1727; Plan de Nerac, 1751; La Radezyge, 1758; Mal de la Bale de St. Paul, 1770; La Facaldina, 1786; Maladie de Fiume, 1800; Maladie de Chavanne Lure, 1829), and who has an up-to-date knowledge of yaws, will, I am sure, be convinced without any doubt whatever that sabbens was not yaws and that it was syphilis.

I am afraid, too, that some of the arguments put forward by Doctor Burke in support of the duality of syphilis and yaws can not be upheld as of any value. He states:

"In contrast with syphilis the primary lesion of yaws is seldom genital, and it is usually preceded by marked constitutional symptoms * * *. In yaws there is little or no adenitis, the type of exanthem is single, there is great itching * * *. The one disease does not confer immunity against the other."

These statements need amendment. The primary lesion in syphilis among certain native communities may commonly be extragenital; constitutional symptoms may or may not occur in yaws as in syphilis; adenitis may be quite common in yaws and itching absent. Many types of skin lesion have been described in yaws.

As regards immunity Doctor Burke would appear to be ignorant of the more recent experimental work on cross immunity.

I am, sir, yours faithfully,

HUGH S. STANNUS.

WIMPOLE STREET, W., May 18, 1931.

Captain Butler's reply to the Stannus letter of May 2 appeared in the *Lancet* of June 6, 1931. Burke also commented on the Stannus letter of May 23 in the same issue. The Butler and Burke letters follow:

SYPHILIS AND YAWS

To the EDITOR OF THE LANCET.

SIR: In your issue of May 2, Doctor Stannus calls in question my remarks on the immorality of certain medical fallacies.

The substance of his objections is as follows:

1. Unhappily, Captain Butler drew his inspiration from Berkeley Hill and E. Lancereaux—two nineteenth-century writers upon syphilis—the first of whom was so ignorant of framboesia that he says “sibbens resembles it,” while Lancereaux didn't even know that pian and yaws were synonymous.

2. Not much has been written upon the “unity or duality of these two diseases,” but the majority of those able to judge the evidence take the view that there are two viruses involved.

3. That the onus of proof should be upon those who believe in unity.

In answer to the first charge, the work of Dr. Berkeley Hill is a model of English observation, information, and reasoning upon the disease syphilis. Up to the time of publication he registers in this remarkable work everything that was actually known about syphilis.

In regard to Professor Lancereaux's ignorance of yaws I quote his own words from Volume I of a *Treatise on Syphilis*, page 31:

“The names yaws, pian, framboesia, serve to indicate in different countries a disease, the unity of which, in spite of some opposite opinions, is now generally recognized, and which, like the foregoing epidemic, appears to belong to the domain of syphilis.”

It would seem that these two authors should be cleared of the implications made against them. In my opinion it would be good constructive medicine if every prospective “framboesiologist” were made to know one or the other of these volumes from beginning to end before launching upon his career.

As regards the third charge, that the burden of proof should be upon those who believe in unity, this is the opposite of fairness. When the framboesial syndrome emerged from the obscurity of the past, it was differentiated from syphilis entirely upon clinical and therefore utterly insufficient grounds. The older writers, such as Huxam, Sydenham, and Buchan, were aware that yaws was simply nonvenereal syphilis. During the eighteenth and nineteenth centuries the yaws syndrome was delimited by definition and cases of syphilis that failed to manifest the particular set of symptoms which were contemplated in the term yaws were set apart. The dualist attitude is the most notable case of *petitio principii* within my knowledge. The scientific attitude should have placed the burden of proof upon those who believe that yaws was something different from syphilis.

Thirty years ago at a B. M. A. meeting Sir Jonathan Hutchinson had a contention with several experts in tropical medicine; the others party to this discussion were E. Davies (Samoa), Patrick Manson, D. C. Rees, and Kenneth MacLeod. Hutchinson's contention was that a certain young Englishman, who had contracted yaws in West Africa, was suffering from syphilis. He defended his thesis so clearly, forcefully, and with such admirable reserve that he proved his point to any unbiased mind. His contention was that yaws and syphilis immunized to each other, which in all other diseases is taken as final. Since that date the final answer in all laboratory investigations has proven that Hutchinson was correct. Those who defend the principle of duality here are simply tilting at windmills. If yaws is not syphilis, then all our scientific indices must be uprooted and learned over again.

Doctor Stannus, by implication, is rather doubtful about the capacity of the readers of the *Lancet* to judge in this matter. I should like to call his attention to the fact that this journal and another great English journal, the *British Medical Journal*, have been publishing articles on this subject for over a hundred years. (See *Lancet*, March 8, 1828, on a case of framboesia from the

Royal Infirmary, Edinburgh.) Much of the experience of the great clinician, Hutchinson, was published in these two journals. It has often impressed me how much fairer is the attitude of these two journals on just this point than is that of the majority of American medical journals. Many of these latter will not print manuscripts which try to debunk their cherished fallacies that syphilis found its origin in America and that yaws and syphilis are distinct. The last editions of the two leading textbooks on tropical medicine in English—the ninth edition of Manson-Bahr and the third edition of Castellani and Chalmers—contain many of the same errors as in the first editions. If these authors had profited by the human experiments as put down in Berkeley Hill's book upon the subject of "syphilisation" as practiced from 1850 to about 1880 and by the monkey experiments of that distinguished believer in duality, Dr. Otto Schöbl, 1926 to 1931, they would have seen what a scientific shambles has been made of the theory that yaws is anything but syphilis.

I am, sir, yours faithfully,

C. S. BUTLER,

Captain (M. C.), United States Navy.

WASHINGTON, D. C., May 21, 1931.

TO THE EDITOR OF THE LANCET.

SIR: Frankly admitting my lack of omniscience, I am really anxious to know why it is that the syphilis with which I am familiar is so different from the sibbens of which I have read and from the yaws I have seen and about which, also, I have read. Doctor Stannus states quite definitely that sibbens was syphilis and not yaws; and he thereby implies his belief that syphilis and yaws are distinct disease entities. In this belief we are agreed. Sibbens appeared in Scotland in 1694 and was termed later on *Frambaesia cromwelliana*, owing to it having been introduced by the Protector's soldiers. It is again mentioned by Patrick Blair in his Miscellaneous Observations in 1718. Both these dates are earlier than that quoted by Doctor Stannus. It is mentioned as occurring in Ireland and in Scandinavia in the latter part of the eighteenth and the beginning of the nineteenth century. The descriptions by contemporary writers seem to me to make it tally very closely with yaws and not at all with syphilis. It was nonsexually acquired, and the subsequent course of the disease was framboesial always. In some districts of Russia the unhygienic conditions under which the peasants live is such that there is an enormous amount of nonsexually acquired syphilis. Here, however, the subsequent course of the disease is not that of sibbens but of syphilis. The one never changes into the other.

The difference between syphilis and sibbens is precisely that between syphilis and yaws. All that I have read leaves no doubt whatever in my mind that yaws, sibbens, boubas, plan, radesyge, and parangi are synonymous; and, further, my practical experience of syphilis makes it clear that that disease is an entirely distinct entity. Doctor Stannus and I have probably read many things in common; apparently we have not always put the same interpretation upon what we have read. In the views I hold Doctor Stannus must be aware that I am in quite good scientific company.

I am, sir, yours faithfully,

E. TYTLER BURKE.

MUNICIPAL CLINIC, SALFORD, May 23, 1931.

Captain Butler's reply to both Stannus and Burke, which appeared in the *Lancet* of July 4, 1931, follows:

SYPHILIS AND YAWS

To the EDITOR OF THE LANCET.

SIR: Space would not permit me to give the entire "dozen ways" of showing the ancient European ancestry of syphilis. I will refer to one direct and one indirect method of proof.

A. Corn. Celsus (30 B. C.-A. D. 38), Lib. VI, XVIII, 2, speaking of the genital organs and specifically of phimosis, says, in part, "after overcoming the resistance of the prepuce" (one may almost sense the reduction en bloc) "there are seen ulcers that are situated upon the glans, or the prepuce, or on the penis beyond the glans; some of these are clean and dry, while others are moist and purulent." Now the only common ulcers of the genitals that are clean and dry are Hunterian chancres, and the only ones that are moist and purulent are chancroids and mixed infections. (See E. Lancereaux, *A Treatise on Syphilis*, Vol. I, p. 13.)

Knowing that the Greeks called what we name flat condylomata by their word for fig, *σῦκος*, and that the Romans simply translated this into their word for fig, "figus," and used it for the same lesions, we turn now to the same Roman author, Celsus, Lib. VI, III, and, admitting that none of the ancients knew the connection between genital lesions and constitutional disease, may read with understanding the author's words on sycosis. "There are also ulcers similar to fig called by the Greeks *σύνκωσις*. The flesh overgrows: this indeed is usual. Under this are two varieties. One ulcer is hard and round, the other moist and irregular. From the hard one a sticky material exudes, from the moist more and of a bad odor. Both may be in those parts covered by hair, but the hard round variety usually comes on the beard, the moist generally on the scalp." There is much more here than barber's itch and kerion Celsi. The fact that the author uses to describe these face lesions the same term "figi," as was in general use at that time to define condylomata between the nates, shows that he was describing a condition quite well known to "us tropical framboesilogists." In this connection see The Epigrams of Martial (Lib. VII, LXXI), in which the author pokes fun at his victim with a play upon the word "figus." Martial (43-104) was a layman and not bound by the medical ethics of his day.

Now for the item of inductive proof. At the present time it is recognized that aneurysm requires for its production the special type of mesarteritis produced by *Treponema pallidum* alone. This applies to arteries with lumina no greater than 1 mm. in diameter. Ligation for aneurysm has been a common practice since the time of Galen (131-201). Garrison in his admirable *History of Medicine*, fourth edition, page 109, says, in connection with ligatures for this and other surgical purposes, that there was a special shop on the Via Sacra where they were to be bought. Antyllus, a contemporary of Galen, perfected a technique for the ligation of aneurysm which held the field down to the time of John Hunter (1786). Da Costa recommends the Antyllus method for certain aneurysms, even at the present time.

Now if the Romans showed enough aneurysms to make it possible for surgeons to develop such a worthy technique of cure as that of Doctor Antyllus, it seems reasonable to think that *Treponema pallidum* was getting into their

blood *somehow*, and it is our firm belief that it was through the "clean dry genital ulcers" described by Celsus.

I am, sir, yours faithfully,

C. S. BUTLER,

Captain (M. C.), United States Navy.

NOTE.—In the *Lancet* of July 4, 1931, Dr. Hugh Stannus made a further contribution to the controversy, to which Captain Butler will reply in the *Naval Medical Bulletin* of January, 1932.

DEMENTIA PRAECOX

Dr. R. G. Hoskins, Worcester, Mass., writing in the *Journal of the American Medical Association* of April 11, 1931, believes that the current formulations of the nature of dementia praecox are too complex to afford a suitably comprehensible basis for therapy. A simplified formulation is offered that emphasizes the practical aspect of treatment. The psychosis is regarded as a persistent dream state. It is a protective reaction in a sensitive subject to a sense of personal failure to meet his own standards. The consequent loss of self-respect renders existence in the world of reality intolerable. Therapeutic efforts should be directed to restoring his self-respect, thus eliminating the necessity for the protective reaction. This can best be achieved by correction of faulty standards, by augmenting the patient's store of available energy, by teaching him an improved technique for utilizing existing energy, and by various types of situational therapy. The formulation is susceptible of intelligible detailed presentation to those not conversant with technical psychiatry.

STATUS OF RADIOLOGY

According to Arthur U. Desjardins, Rochester, Minn. (*Journal A. M. A.*, May 23, 1931), irradiation by means of Röntgen ray or radium is now accepted as the most effective method of treating fibromyoma and cervical carcinoma of the uterus, lymphoblastoma, giant-cell tumor and endothelial myeloma of bone, and embryonal carcinoma of the testis. Moreover, knowledge of the specific radio-sensitiveness of different species of cells and of neoplasms derived from such cells is becoming a valuable factor in the identification of certain kinds of tumor. Not only are many varieties of neoplasm now treated by this method but a host of inflammatory conditions as well. Indeed, the latter bid fair to outstrip the former in the next two years. These well-known facts are mentioned only to bring out the point that within 35 years radiology has become an essential factor in medicine, a factor the significance of which is

recognized by every physician. In fact, diagnostic röntgenology has progressed so far that now some physicians, especially the younger members of the profession, place too implicit trust in röntgenologic data and neglect the traditional methods of examination. Although rays can never lie, lack of knowledge or experience may cause the röntgenologist to misinterpret the data furnished by röntgenography or röntgenoscopy. Indeed, excessive trust on the part of clinicians is a danger which the röntgenologist must be careful to avoid. In institutions, as well as in private practice, physicians often expect too much of the röntgenologist, whose sometimes can not make an absolute diagnosis. This is especially true when he is working without any knowledge of the history or clinical features of the case. Under such circumstances, when the röntgenologic signs are not distinctive, the röntgenologist should, and usually does, describe what he finds and mentions the conditions with which the röntgenologic appearance may be associated. To demand more than this is to require that which the referring physician himself should furnish, namely, correlation of the history with the physical and röntgenologic data. Unfortunately, many physicians expect the röntgenologist to do the impossible, and rate him incompetent when he honestly admits failure or inadequacy. On the other hand, some röntgenologists, who are unwilling to confess inability, go beyond their province by making from their observation more or less unwarranted diagnostic deductions.

AMERICAN COLLEGE OF PHYSICIANS

MEETING IN SAN FRANCISCO, 1932

The American College of Physicians will hold its sixteenth annual clinical session at San Francisco, with headquarters at the Palace Hotel, April 4-8, 1932. Following the clinical session a large percentage of the attendants will proceed to Los Angeles, where a program, principally of entertainment, will be furnished April 9, 10, and 11.

Announcement of the dates is made, particularly with a view not only of apprising physicians generally of the meeting, but also to prevent conflicting dates with other societies that are now arranging their 1932 meetings.

Dr. S. Marx White, of Minneapolis, is president of the American College of Physicians and will arrange the program of general sessions. Dr. William J. Kerr, professor of medicine at the University of California Medical School, San Francisco, is general chairman of local arrangements, and will be in charge of the program of clinics. Dr. Francis M. Pottenger, of Monrovia, is president elect of the col-

lege, and will be in charge of the arrangements at Los Angeles. Mr. E. R. Loveland, executive secretary, 133-135 South Thirty-sixth Street, Philadelphia, Pa., is in charge of general and business arrangements and may be addressed concerning any feature of the forthcoming session.

GRADUATE FORTNIGHT OF THE NEW YORK ACADEMY OF MEDICINE

The disorders of the circulatory system, which have in the last decade placed "heart disease" in the forefront of the principal causes of death, will constitute the theme of the fourth annual graduate fortnight of the New York Academy of Medicine.

This graduate course of instruction will consist in a series of lectures and clinical demonstrations, concentrated in a period of two weeks, from the 19th to the 30th of October, 1931.

Lectures will be delivered evenings in the auditorium of the New York Academy of Medicine, 2 East One hundred and third Street, New York City. Clinical demonstrations will be held during afternoon in 12 of the leading hospitals of the city. The demonstrations will be in charge of teaching clinicians and will be organized so that those participating will have the full benefit of individual contact with both demonstrator and patient.

An outstanding feature of the 1931 graduate fortnight will be the anatomical, bacteriological, and pathological exhibition of specimens and research material bearing upon the subjects dealt with in the evening meetings and clinical demonstrations.

This exhibit will be housed in the academy and will be open for leisurely study. A number of the exhibited items will be demonstrated on schedule and subjected to group discussion.

The profession of the country is invited to attend and participate in the graduate fortnight. There is no charge for attendance at any of the clinics or meetings, but registration for the clinical demonstrations is required.

A complete program and registration blank for the clinics and demonstrations may be secured by addressing the New York Academy of Medicine, 2 East One hundred and third Street, New York City.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

HEART DISEASE, by *Paul Dudley White, M. D., Instructor in Medicine, Harvard Medical School; Physician, Massachusetts General Hospital, Boston.* The Macmillan Co., New York, 1931. Price, \$12.

It would be difficult, perhaps impossible, to overrate the value of this book or its position in the medical literature of recent years. It could only have been written by a man who is a great cardiologist, a great teacher, and an indefatigable student and worker, inspired by his attainment of a mastery of the present knowledge of heart disease, and yet knowing and seeing as much as anyone the great fields of investigation that lie ahead—the need for probing into a very large number of still unsolved problems of this still pioneer science, in order to bring understanding and clearness to the many aspects that are still in a state of obscurity.

The plan of the book is well described by the author.

There are four parts: The first deals with the examination of the patient and the analysis of his symptoms and signs, the second discusses the etiological types and causes of heart disease, the third deals with the structural changes present in the heart and great vessels, and the fourth takes up disorders of function. No longer in the diagnosis of heart disease can we be content to think of pathology alone, nor yet should we abandon these structural changes to consider function alone. According to our present knowledge and aspirations, we ought, in every patient with heart symptoms and signs, to think not only of these two diagnoses—structural and functional—but to add, as perhaps most important of all, a third, namely, etiological. * * * The arrangement of the book has therefore followed such a plan.

There are about 700 pages of text, with 119 illustrations. There are about 200 pages of bibliography, appearing in a special section, and thus facilitating reference without distracting the reader's atten-

tion from the text. One finds here a quite exhaustive list, arranged conveniently by grouping the references into subject classes and listing all the works alphabetically as to authors.

A very special and most stimulating feature is the appendix, containing a list of 108 unsolved cardiovascular problems. These include problems of etiology, problems of pathogenesis of structural cardiovascular abnormalities, problems of disorders of function, of origin of certain signs, of treatment, and of preventive medicine.

RESISTANCE TO INFECTIOUS DISEASES, by *Hans Zinsser, M. D., Professor of Bacteriology and Immunity, Medical School, Harvard University, etc.* Fourth edition. The Macmillan Co., New York, 1931. Price, \$7

This book is for the serious student of the rapidly advancing science of the biological phenomena which underlie infection and the animal body reaction to infection.

The third edition of Zinsser's *Infection and Resistance* appeared eight years ago. This new edition now appears under a new title, perhaps a more fitting title in view of the applications of the principles of this science by the modern physician. Since the last edition many remarkable advances have occurred which have greatly increased the need for this new edition.

Among these advances should be mentioned a clearer understanding of the chemistry of antigens and the physicochemical principles of antigen-antibody reactions, the work of the Wells school on antigenic specificity, and Landsteiner's studies on conjugated proteins and specificity. These and other notable advances have combined to lift investigations in this very important field above the trial and error level and have placed them well in the class of the fundamental sciences which depend upon experimental precision. Briefly, the science of immunology is becoming one of the exact sciences.

Although the author regards the book more as an attempt to correlate the facts of the various sciences as they are related to medical immunology than as a complete treatise, the book remains, nevertheless, the most complete treatise that can be found in one volume.

As it stands it constitutes a splendidly presented outline of all phases of the subject, and this, happily, in only 600 pages.

The book is in no sense a laboratory guide, and technical details of diagnostic methods have thus been omitted.

There are 23 chapters which deal with the many topics that come under the general principles of infection and resistance and 6 chapters which concern the special problems of immunology in many individual infectious diseases.

THE PHYSICIAN OF THE DANCE OF DEATH, by *Aldred Scott Warthin, Ph. D., M. D., LL. D., Professor of Pathology and Director of the Pathological Laboratories in the University of Michigan, Ann Arbor.* Paul B. Hoeber (Inc.), 1931. Price, \$7.50

About two years ago, when Warthin's *Old Age* appeared, we found that the author could write a most intriguing book on a very gloomy subject. It was a brilliant and scholarly treatise, based on a sound physiology and an admirable philosophy.

Now comes this still finer work on a still gloomier subject.

Nearly 40 years ago, when the author was a medical student on his way to Vienna, he chanced to see in a Nuremberg shop window a print of Albrecht Dürer's *Ritter, Tod und Teufel*. He was, of course, inspired by the attitude of the knight in this painting, who had vowed that—

Across my path though Hell should stride,
Through Death and Devil I will ride.

This picture and Alfred Rethel's two great woodcuts, *Der Tod als Erwärger* and *Der Tod als Freund*, formed the beginning of the author's remarkable collection of the representations of Death in Art and his equally remarkable collection of books which deal with art portrayals of the Dance of Death. He has thus been a profound student as well as prodigious collector in this field for more than 30 years.

Now he presents the story of man's changing reactions to the concept of death throughout the periods of the last six centuries.

The *Toten Tanz* motive had an extraordinary vogue in the Middle Ages in Europe, both in art and literature, because the almost constantly present wars and pestilences and famines served as daily reminders that death was always lurking just around the corner.

Warthin has been particularly interested in the portrayal of the physician in these Dance of Death pictures through the different centuries, since we can trace here the changes in the social standing of the physician and the developments in medical knowledge and practice.

There are 108 reproductions of famous paintings of the Dance of Death, dating from the fourteenth century to the most modern works. The modern treatment of the theme, according to Warthin, depicts "an altered attitude towards death, in its representation as a desired release from suffering and unhappiness. * * * The modern has lost his fear of death and meets it with resignation or bravery, or with cynical indifference."

The historical treatment of the evolution of the Dance of Death falls logically into the following periods: (1) The Period of the Great Wall Paintings; (2) the pre-Holbein Manuscripts, Block Books, and the Incunabula; (3) Holbein; (4) the imitators of Holbein; (5) the Period of Caricature; (6) the Modern Dance of Death.

It is impossible to overstate the beauty of this book. The paintings are chosen with fine discrimination; they are beautifully reproduced; and they are described and expounded upon in the Warthin style, which combines here his fine literary touches, his love for precision, and his feeling for and knowledge of art.

The house of Hoeber is again to be congratulated on the production of a book that reminds us of the high artistic standards for which this publisher has become so well known.

NUTRITION AND DIET IN HEALTH AND DISEASE, by *James S. McLester, M. D.*, *Professor of Medicine at the University of Alabama, Birmingham, Ala.* Second edition. W. B. Saunders Co., Philadelphia, 1931

A very comprehensive text; one of many that have appeared on the subject of nutrition during the current year.

A fortunate feature is the space (some 150 pages) devoted in the first four chapters to the underlying physiology of nutrition. In these four chapters there is an excellent exposition of metabolism, digestion and absorption, and nutritional factors of fundamental importance.

The remaining chapters concern the food values of the various foodstuffs, diet in health, and nutrition in disease.

A special section contains numerous reference charts and tables of importance to those who must prescribe or prepare special diets.

The chapter on the feeding of infants is written by McKim Marriott. A chapter on the feeding of surgical patients is by Barney Brooks.

Sections have been added in this edition on the toxemias of pregnancy, food poisoning, irritable colon, and protozoan infections.

The sections on enzymes, protein requirement, epilepsy, and diseases of the blood have been rewritten.

On page 101, and again on pages 342, 343, and 344, the author reveals some skepticism as to Goldberger's conclusions regarding the etiology of pellagra. Such a stand will impress those familiar with the quality of Goldberger's work as a foolhardy display, indeed, for when one expresses a doubt of conclusions that bear the incomparable stamp of Goldberger's name one should be extremely sure of his premises—certainly more sure than Doctor McLester can be from the evidence he presents in his chapter on pellagra.

MILITARY PREVENTIVE MEDICINE, by *George O. Dunham, M. A., M. D., Dr. P. H., D. T. M. and H. (Lond.)*; *Major, Medical Corps, U. S. Army; Director, Department of Sanitation, Medical Field Service School.* Second edition. Medical Field Service School, Carlisle Barracks, Pa., 1931

The first edition of this book appeared in 1930 and was accorded some well-merited praise in the *BULLETIN's* review of January, 1931.

The extreme value of this book to military sanitarians was so evident that the bureau obtained a number of copies for distribution to certain activities where it would be of most use. The same procedure will be followed with this second edition, just issued.

It represents a compilation of the work of the department of sanitation of the Medical Field Service School at Carlisle Barracks, Pa., and as such may be considered the latest and most authoritative book on field hygiene published. The work is distinguished by the clearness and completeness of the information given on each subject, and both of these features are enhanced by the large clear type used in printing the book and the number of excellent pictures. Of particular value to naval medical officers, who may at any time be called upon to serve with Marine Corps expeditionary forces, are the emphasis placed upon field sanitation as an administrative problem, the fine description of water purification in the field, and the disposal of sewage and kitchen wastes in camp and on the march. The measures for the control of important diseases are so carefully and completely given as to make these sections valuable reference texts. Another special feature is the extensive section devoted to food standards and food inspections. Eighty-two pages are devoted to milk and dairy products alone, and included are a model milk ordinance and model score cards for the inspection of dairy plants and products.

The entire text has been revised and brought up to date in this new edition, and two chapters have been added—one on the administrative features of physical examinations and the other on vital statistics. In order to clarify certain portions of the text, 54 additional illustrations have been included.

PRACTICAL METHODS IN THE DIAGNOSIS AND TREATMENT OF VENEREAL DISEASES,
by *David Lees, D. S. O., M. A., M. B., D. P. H., F. R. C. S., M. R. C. P. (E).*
Surgeon in Charge of Venereal Diseases, The Royal Infirmary, Edinburgh,
etc. Second edition. William Wood & Co., New York, 1931. Price, \$5

A very well put together manual on venereal diseases, covering some 600 pages, and including about 90 illustrations and 8 splendid colored plates.

The aim of the book has been completely achieved—that of presenting sound principles of diagnosis and practical details of modern treatment.

In view of the frequency with which practitioners are called on to diagnose and treat cardiovascular syphilis, a new chapter has been written on this subject. The chapters on neurosyphilis and its treatment have been largely rewritten and brought abreast of modern teaching by including a statement of the effect of treatment

by tryparsamide, malaria, and other forms of pyrotherapy. Short additions to the text have been made on diathermy in the treatment of the complications of gonorrhea and on the treatment of chancroid.

The book forms a valuable contribution to the practical side of an all-important subject.

RECENT ADVANCES IN THE STUDY OF THE PSYCHONEUROSES, by *Müllers Culpin*, M. D. (Lond.), F. R. C. S. (Eng.), *Lecturer in Psychoneuroses at the London Hospital Medical College and in Medico-Industrial Psychology at the London School of Hygiene and Tropical Medicine*. P. Blakiston's Son & Co., Philadelphia, 1931

Just as Strecker and Appel's book is a splendid elementary presentation for the layman, this is a book that can be commended in the highest terms as a treatise that will capture the interest and respect of the physician and psychiatrist and psychologist.

Doctor Culpin has handled here a peculiarly difficult theme in an admirable fashion.

To speak of "advances" one must have a system of standards of theory and practice at a given time and an assumed knowledge of the subject on the part of the reader as working bases. Neither of these bases exists in the present study. The study here involves a controversy based upon fundamental differences in outlook.

Nearly all the advances in our understanding or treatment of the psychoneuroses have in some way resulted from psychoanalytical discoveries. The more recent advances lie in our changing attitude toward the psychoneuroses and our recognition of their clinical significance.

In order to present a complete and clear picture of these changes in attitude, it is necessary to give a historical outline by way of introduction. This the author has done in an exceedingly creditable fashion and in the space of only 15 pages. His phraseology in this section is particularly apt. For example, in speaking of descriptive psychology, he says that this "proved sterile," and "to call it 'the definition of the obvious in terms of the unintelligible' was not altogether unfair."

There are especially illuminating chapters on psychoneuroses of the war, occupational neuroses, and the present position of psychoanalysis.

The views of Jung and Alfred Adler are given more importance by some psychotherapists than this author admits, so he has done a very reasonable thing in having these views presented by his colleagues, James Young and A. R. Redfern.

Child psychology and the management of a clinic are also treated in separate chapters by E. Miller and J. R. Rees.

THE CRIMINAL, THE JUDGE, AND THE PUBLIC, by *Frans Alexander, M. D., Visiting Professor of Psychoanalysis at the University of Chicago, and Hugo Staub, Attorney at Law, Berlin.* The Macmillan Co., New York, 1931. Price, \$2.50

During the last 10 years the Psychoanalytical Institute of Berlin, under the direction of Dr. Max Eitington, has been successfully demonstrating that psychoanalysis has a range of application that reaches quite beyond the domain of therapy and extends into a variety of fields of study which have to do with human psychology and human behavior.

In this book the authors (one, a physician of world-wide reputation as a leading exponent of the school of psychoanalysis; the other, a distinguished German jurist) present in a most lucid and convincing fashion the first authoritative psychoanalytical study of criminal psychology and the psychology of punishment that has been offered to the general reader in America. It has only been preceded in American literature by the strictly medical professional writings and by a host of popular works which have dealt principally with the supposedly alluring features of sex and love "in the narrowest and shallowest sense of these words" [translator]. As the translator has well put it, the general reader has, with rare exceptions, "been steadily regaled with a mass of popularized catchwords surrounded by a questionable halo of erotic inferences under the guise of psychoanalysis."

This treatise should serve as a stimulus toward the future development of a psychoanalytical criminology and should be of profound interest and importance not only to the medical psychoanalyst, the medicolegal expert, and jurist, but to the general public, since justice is usually dispensed under the control of public opinion and our whole dealings with problems in criminology are matters of vital concern to society in general.

Many readers, especially the casual readers who fail to appreciate the necessity for the complete emotional detachment of the authors in their viewing of these matters, may suspect that the book is a defense of criminals and criminal acts—that it serves the interests of the criminal rather than the public. While it may be true that *tout comprendre c'est tout pardonner*, the authors have well succeeded here in clearing themselves of having attempted to do more than analyze the motives of criminals. An understanding of the motive involved in any given crime should certainly serve the interests of society, since the judgment passed (by the court and by the public) will always depend upon the motives.

That our modern system of imposing punishment is in critical need of revision no one can doubt. This book is not even an attempt

at a complete answer to the question of what that revision should be. It is a contribution to our understanding of the facts that this problem of revision presents.

Few books which have undergone a translation have lost so little in the process as this book, and the translator here is to be congratulated upon the rare ability he has shown in handling this particularly difficult job. He has taken the characteristically involved German version of an especially involved subject filled with a very special terminology and has transformed it into an intensely readable and clear, smooth-running, understandable, and quite engaging account in English.

DISCOVERING OURSELVES, by *Edward A. Strecker, A. M., M. D., and Kenneth E. Appel, Ph. D., M. D.* The Macmillan Co., New York, 1931. Price, \$3

Doctors Strecker and Appel have here achieved the almost impossible—that of presenting authoritatively, simply, in primer form and in a popular vein our modern concepts in the wide and forbiddingly abstruse fields of psychology and psychiatry. We only know of one other book that has accomplished this rare feat in recent years—Menninger's *The Human Mind*.

Discovering Ourselves really enables the layman of average intelligence or more to discover himself; it gives him a well-focused view of the human mind and its workings. It is rather too elementary for those who have devoted much study in these subjects.

It is an excellent treatise for many of those who talk glibly of complexes, introverts, extroverts, etc., without having much understanding of what they are talking about. A careful reading of this book is certain to reward one with a satisfying acquaintance with these terms and a knowledge of their meaning.

The descriptions of persons illustrating this or that complex are so vivid that we recognize in them many of our acquaintances and only too often, alas, ourselves.

Much of the book is built around the authors' proposition that "there are three great complexes which chiefly dominate the thinking and determine the action of the majority of adults. They are the ego complex, the sex complex, and the herd complex. The instincts and emotions may be grouped under these three complexes. The serious *conflicts* that arise in our lives usually may be traced to the opposing claims of these three complexes."

Most unfortunately, there are many diagrams which have been included for the purpose of strengthening the points in the text. They might be of aid to some readers—this reviewer thought them rather puerile, and falling far short of serving any purpose.

SURGERY, ITS PRINCIPLES AND PRACTICE, by *Astley Paston Cooper Ashhurst, M. D., F. A. C. S., Professor of Clinical Surgery, University of Pennsylvania; Surgeon to the Episcopal Hospital and Philadelphia Orthopaedic Hospital and Infirmary for Nervous Diseases.* Fourth edition. Lea & Febiger, Philadelphia, 1931. Price \$10

A well-proportioned and neatly worded text in 1,100 pages, and using 1,063 well-chosen illustrations and 15 colored plates. The book belongs with the three or four very best 1-volume works on surgery which have appeared in recent years.

A hundred pages have been well devoted to fractures, and slightly more than a hundred to orthopedic surgery and diseases of bones and joints.

It was somewhat disappointing to find still included a chapter on venereal diseases, a subject which scarcely belongs in a modern text on general surgery.

The revisions are numerous and are in keeping with the most recent advances, such as those which concern spinal and rectal anesthesia, thrombo-angiitis obliterans, and the injection treatment of varicose veins.

OPERATIVE SURGERY, by *Dr. Martin Kirschner, Professor of Surgery and Director of the Surgical Clinic at the University of Tübingen (Germany).* J. B. Lippincott Co., Philadelphia, 1931. Price, \$12

There is always a place in surgical literature for a volume that gives detailed explanation of the operative procedures. This is particularly true when such a work is well illustrated.

In referring to the 746 illustrations, an outstanding feature of the book, Doctor Ravdin rightly states: "The illustrations are so well done that very little is left to the surgeon's imagination."

The author treats of many phases of the subject which have been to a large extent neglected. There has been no attempt, however, to cover the entire field of surgery. The 11 chapters discuss in a very practical manner the following subjects:

The general management of the patient and the general principles of operative technic; the various methods of anesthesia; control of infection; control of hemorrhage; operations on the skin and subcutaneous connective tissue; operations on muscles, tendons, and fascia; the surgery of blood vessels; operations on the nerves; bone surgery; operations on joints, amputation and disarticulation.

RENÉ THÉOPHILE HYACINTHE LAENNEC, by *Gerald B. Webb, M. D., President Colorado School of Tuberculosis, Colorado Springs.* Paul B. Hoeber (Inc.). New York, 1928. Price, \$2

Laennec has been the subject of many a short biographical essay and not a few biographies in book form, both in English and French.

The most complete account of Laennec's life is found in the 2-volume work by Alfred Rouxau, 1912 and 1920, unfortunately not yet translated into English.

Notable among the shorter works are Thayer's two essays (1919 and 1920) and his address at the Laennec Centenary in Paris, 1926; Victor Robinson's essay in 1921; and Sir William Hale-White's Translation of Selected Passages from *De l'Auscultation Médiante*, with Short Biography of Laennec, 1923.

This book of Webb's is without question the finest account in English that has appeared to date. Doctor Webb is especially well fitted to appreciate Laennec and to express this appreciation. He knows Laennec's country and has even visited the scenes of Laennec's life. He knows the language and culture of France. He was one of the American delegates to the Laennec Centenary. He knows French history and medical history, and, being a worker of note in tuberculosis, he has had a natural and special interest in the history of tuberculosis—a history whose most important chapters must be devoted to the contributions of Laennec.

It was Laennec of whom Thomas Addison said (1846), he "contributed more towards the advancement of the medical art than any other single individual"; of whom Osler said that his description of pneumonia was unsurpassed; of whom Thayer said (centenary address), "The epoch of Laennec marks the beginning of our exact knowledge of the nature of the scourge which has robbed humanity of its most cherished hopes and Laennec of his last efforts."

Webb's book is made no less delightful by his rather frequent wanderings into the lives of some of Laennec's contemporaries, his descriptions of French scenes, and his remarks on events in the history of France in Laennec's time.

Done with particular skill are Webb's treatment of the personality of Laennec's father, who was prodigal in promises but backward in cash remittances (reminding one of President Andrew H. Brown, of the renowned taxi company); and of Laennec's Uncle Guillaume, who could see the young nephew's greatness and backed this opinion by hard cash, by every encouragement and affection, and by prodding the father to lend his moral and (meager) financial support during the student days.

There is much pertinent matter on the medical schools and practice of France in the early part of the nineteenth century, and good estimates of such men as Corvisart, Dupuytren, Bayle, and Broussais. Especially interesting are the accounts of Laennec's professional quarrels with Dupuytren and Broussais.

There are several fine portraits of Laennec. That by Dubois (1812) is said to be the only authentic one; but more appealing is the reputed sketch of Laennec by himself, at Kerlournec, 1820.

THOMAS SYDENHAM, by *David Riesman, M. D., Professor of Clinical Medicine, University of Pennsylvania*. Paul B. Hoeber (Inc.), New York, 1926. Price, \$1.50

A charming little book about a remarkable man—the greatest medical man of his day except Harvey.

The medical world's interest in Sydenham was increased in 1924 by the wide celebration of the tercentenary of his birth. Much was written and spoken on Sydenham during that year, but, with the exception of Sir George Newman's short biography of Sydenham, it is doubtful if any of these numerous accounts show such a fine understanding of Sydenham's genius as does this 46-page work by Riesman.

Riesman sees very clearly the place Sydenham held in the medical world of the seventeenth century and the momentous influence Sydenham's contributions have had on the progress of medicine.

Riesman is, of course, an admirer of Sydenham's personality and philosophy as well as Sydenham's perception and logic. He shows this admiration in his selections of quotations from Sydenham, such as the following: "I have weighed in nice scrupulous balance whether it be better to serve men or be praised by them, and I prefer the former." And this from the preface of the famous treatise on gout and dropsy: "It is my nature to think where others read; to ask less whether the world agrees with me than whether I agree with the truth; and to hold cheap the rumours and applause of the multitude."

In praise of Sydenham's skill as a medical essayist, Riesman finds it "refreshing" to come upon "a medical essay detailing in simple language the experience and well-reasoned conclusions of an independent thinker," and well states the matter in noting that Sydenham was "the first real clinician * * * since Hippocrates to observe and to note the lineaments of disease and to record what he saw with unsurpassed objectivity."

There is an admirably worded and happily brief account of Sydenham's contributions to the knowledge of malaria, tuberculosis, gout, and chorea, and his work in popularizing the use of cinchona bark.

A bibliography lists the 14 important writings of Sydenham.

THE LIFE AND TIME OF ADOLF KUSSMAUL, by *Theodore H. Bast, Ph.D., Associate Professor of Anatomy, University of Wisconsin Medical School*. Paul B. Hoeber (Inc.), New York, 1926. Price, \$1.50

The name of Adolf Kussmaul is so well known among English-speaking medical men that there is a definite need for an account of his life and times in English. The autobiography of his early life and the scattered accounts of his later life are recorded almost solely in German.

This narrative, happily in English, is based largely on the two sketches by Kussmaul, *Jungenerinnerungen eines alten Arztes* and *Aus Meiner Dozentenzeit in Heidelberg*, and numerous publications by his students and other scientists which concern his later life.

This gives an intimate picture of the man and of his teachers, students, and other associates, such as Nägele, Puchelt, Rokitansky, Virchow, Skoda, Tiedemann, Bischoff, Henle, Müller, Gemelin, and Semmelweis.

There is an excellent account of student life and of the status of medical education and practice in Heidelberg, Vienna, Prague, and Strasburg in the nineteenth century.

Kussmaul has many claims to an enduring and high place in the history of medicine. He contributed many noteworthy items to our knowledge of several branches of medicine; he attained a masterly proficiency and knowledge in toxicology, legal medicine, internal medicine, obstetrics, and physiology; he was the inspirer of countless students during a period of 42 years.

This little book with its excellently presented matter should be a highly valued member of any library of the history of medicine.

PRINCIPLES OF ANATOMIC ILLUSTRATION BEFORE VESALIUS, by *Fielding H. Garrison*, A. B., M. D. Paul B. Hoeber (Inc.), New York, 1926. Price, \$2.50

This little book of some 60 pages of text and 22 very engaging illustrations can not be read in the time one might suppose necessary from its size and appearance. The fact is, it may require several readings and considerable study before the reader acquires much of an idea as to its thesis.

Garrison, it seems, likes to speak in riddles, and it is difficult to escape the suspicion that he derives a certain satisfaction in saying almost everything in a manner that will make his statements least understood. By his own admission, wittingly or not, he says (p. 7) that he has arranged the facts "in a certain way in order to stimulate thought." Here he stimulates more than thought; he stimulates some wonder and puzzling, some head scratching, and an occasional profane expletive. He employs numerous foreign words and phrases for which there are ample English equivalents that serve the case just as well or better.

When one sits down to read Garrison, unless he possesses Garrison's rare erudition—there are millions of readers who can not claim such—he must have at his elbow a good encyclopedia and an assortment of large dictionaries in several languages.

Garrison's stated "immediate object" here "is to demonstrate * * * that the real content of artistic anatomy is not descriptive anatomy but ethnic morphology, physiology, and pathology." What does he mean by "ethnic morphology"? Perhaps he means the

features and shapes and other physical characteristics of the peoples of various races. Or he may mean something quite remote from this interpretation.

If I can gather much of the import of the book, he is pleading for greater visual perception in medical practice—a perception such as set Leonardo apart from the thousands of pre-Vesalians who were bound by “servile adherence to tradition.”

Garrison's conclusions as to the prehistoric and primitive woman, based on the Venus of Willendorf, follow a line of reasoning that appears so flimsy that the whole discussion on this point becomes a brightly comic spot of the book. He finds the figure “distinctly negroid,” a finding which must indeed have required some extraordinary visual perception. He concludes from the gigantic breasts and buttocks of the figure that these are characteristic of primitive and prehistoric races, and that the women of those races followed certain diets and habits. Perhaps he is correct, but a hundred other explanations would be just as plausible. The sculptor of this figure was certainly no realist. He may have been a genuine artist, depicting not what he saw but a grotesque concoction of his own desire. The same may be said of the recumbent female figure from Hal Safi-fiene. Large buttocks may simply have been the vogue, achieved in no greater proportion of the female population than to-day, either in primitive or civilized races, or than in the nineteenth century, when the ladies of the civilized world affected them by means of the bustle.

The last half of the book is much more readable and constitutes a most illuminating and stimulating discourse, philosophical and historical, on anatomical art before Vesalius. The discussion about Leonardo is fascinating and brilliantly Garrisonian.

The illustrations make up a collection that should be highly prized.

MAX VON PETTENKOFER, by *Edgar Erskine Hume, M. D., Dr. P. H., LL. D., Major, Medical Corps, U. S. Army.* Paul B. Hoeber (Inc.), New York, 1927. Price, \$1.50.

A well-written account of the life and work of the remarkably versatile Max von Pettenkofer, who became first a great chemist, then a great pioneer epidemiologist and pioneer in the teaching of hygiene.

The book is divided into two essential sections—the biographical account, including the mention of his more important and widely diverse contributions to knowledge in chemistry and hygiene; and the account of his theories as to the etiology of cholera and other intestinal diseases, with a tabular listing of the differences between the views of Pettenkofer and Koch.

The bibliography includes 227 published works of Pettenkofer. The illustrations include two excellent portraits of Pettenkofer.

THE HISTORY OF HEMOSTASIS, by *Samuel Clark Harvey, M. D., Professor of Surgery, Yale University; Surgeon in Chief, New Haven Hospital.* Paul B. Hoeber (Inc.), New York, 1929. Price, \$1.50

Doctor Harvey has here traced in a most informative way the thread of hemostasis from earliest times "amidst the varying fortunes of surgery" down to the present day.

There is a lucid account of the beliefs of primitive people concerning the subject of hemorrhage.

The methods subscribed to by Galen, Hippocrates, Oribasius, Paul of Aegina, the Greco Romans, and the Arabians are interestingly described.

Paré escaped from tradition as to methods of controlling hemorrhage, and learned his anatomy from dissection rather than books. He was the first to use the ligature in amputations. In 1564 he advised against the cautery, and was the first to use the *bec de corbin* "the true ancestor of the artery forceps."

Harvey's *De Motu Cordis*, in 1628, of course brought order and understanding to the study. Morel's introduction of the tourniquet in 1700 and Hewson's studies on coagulation in 1701 again furthered the advance of hemostatic technique. Von Graefe was doing goiter operations as early as 1822, but it remained for such as Bruns, Kocher, and Halsted to perfect the details of hemorrhage control in this very vascular area.

The author quotes Halsted's interesting account of the scarcity of artery forceps in New York hospitals as late as 1880.

To Lister we are chiefly indebted for the introduction of absorbable and sterile ligature material.

There are excellent illustrations of hemostatic instruments in use in various centuries, and some fine portraits of Paré, Philip Syng Physick, and Lister.

CLINICAL DIAGNOSIS BY LABORATORY METHODS, by *James Campbell Todd, Ph. B., M. D., Late Professor of Clinical Pathology, University of Colorado, School of Medicine, and Arthur Hawley Sanford, A. M., M. D., Professor of Clinical Pathology, University of Minnesota (The Mayo Foundation); Head of Section on Clinical Laboratories, Mayo Clinic.* Seventh edition. W. B. Saunders Co., Philadelphia, 1931. Price, \$6

This well-known and widely used laboratory manual has developed into a full-sized textbook on a branch of medicine that has become a specialty, namely, clinical pathology.

The arrangement and style of presenting the subject, which have always been popular with both the instructor and student, continues the same as in the previous editions.

New methods added include Folin's 1929 method for precipitation of protein from blood and body fluids, his modified method for de-

termination of uric acid in blood, and his revised copper solution for determination of blood sugar; method of determining blood volume and plasma volume by Keith, Rowntree, and Geraghty; Clark and Collip's method of determination of calcium; Corper and Uye's method for the culture of bacteria of tuberculosis; a discussion of the Ascheim-Zondek test for pregnancy.

As a rule, laboratory manuals after repeated revisions contain too many tests for the same purpose, too many little used or obsolete tests, and show a tendency to an expanding appendix. Doctor Sanford avoids these faults and produces an edition of convenient size, which at the same time contains all the essential clinical laboratory procedures, considerable information of value in the appendix, and a very useful index of laboratory findings in important diseases.

DIAGNOSTIC METHODS AND INTERPRETATIONS IN INTERNAL MEDICINE, by *Samuel A. Loewenberg, M. D., F. A. C. P., Associate Professor of Medicine, Jefferson Medical College; Assistant Physician to the Jefferson Hospital, etc.* Second edition. F. A. Davis Co., Philadelphia, 1931. Price, \$10.

This is an extremely comprehensive treatise, using about 1,000 pages of text and 547 illustrations. It is written "from the standpoint of the rapidly disappearing 'general practitioner.'"

Many readers will feel that the author has attempted to cover too many and too widely diverse subjects in a 1-volume work, but a book of this type will doubtless be found of considerable value by a large medical reading public, including students, practitioners, and others. Its value has already been attested by the exhaustion of two large printings of the first edition.

In this edition many new subjects have been added—for example, the cardiac blood supply and innervation, massive pulmonary collapse, coronary thrombosis, sickle cell anemia, agranulocytic angina, acute mononucleosis, and the importance of certain findings in the cerebrospinal fluid.

While most of the illustrations are excellent, many of them fail to illustrate the points expected of them.

FOOD ALLERGY, ITS MANIFESTATIONS, DIAGNOSIS, AND TREATMENT, by *Albert H. Rowe, M. S., M. D., Lecturer in Medicine in the University of California Medical School, San Francisco, Calif., etc.* Lea & Febiger, Philadelphia, 1931. Price, \$5

This volume deals primarily with the problem of food allergy. The author is of the opinion that this type of allergy is more frequently the cause of disturbances in the human body than is recognized. This delayed recognition he ascribes to the negative skin reactions which so frequently occur to foods which are productive of sensitization in the patient.

For this and other reasons outlined in Chapter II, diet trial is placed ahead of skin testing as a method of diagnosis.

The importance of diet trial is stressed not only in diagnosis but also in treatment, and a full discussion of diets is given in Chapter III. Included are methods such as semifasting, the food addition method of Brown, dietary manipulation as suggested by Alexander and Eyer mann, and the author's elimination method.

The following chapters discuss in a most complete manner those diseases certain cases of which have been shown to be caused by food allergy. Among the conditions considered are bronchial asthma, perennial hay fever, dermatitis and eczema, urticaria and angio-neurotic edema, migraine, neuralgia, gastrointestinal symptoms of many types (including canker sores, nausea, vomiting, colic, generalized or localized abdominal pain and colitis), bladder allergy, allergic toxemia, and occasional cases of epilepsy, fever, fatigue, joint pains, as well as other conditions, such as Henoch's purpura.

The entire literature of food allergy has been reviewed and a complete bibliography of the subject is appended.

CLINICAL DIETETICS, A TEXTBOOK FOR PHYSICIANS, STUDENTS, AND DIETITIANS, by *Harry Gauss, M. S., M. D., F. A. C. P., Instructor in Medicine, University of Colorado, School of Medicine.* The C. V. Mosby Co., St. Louis, 1931. Price \$8

A book to meet the needs of the student, the hospital dietitian, and the patient. With few exceptions the diets selected have a rational basis, and they are preceded by a discussion of the medical and biochemical aspects. Dietetic management of the following disorders is discussed: Fever; gastric and intestinal disorders; disorders of the liver and gall bladder; diabetes; obesity; renal-vascular diseases; cardiac disorders; epilepsy; vitamin deficiency diseases; gout and arthritis; food poisoning and allergy.

PRACTICAL DIETETICS FOR ADULTS AND CHILDREN IN HEALTH AND DISEASE, by *Sanford Blum, A. B., M. S., M. D., Head of Department of Pediatrics and Director of the Research Laboratory, San Francisco Polyclinic and Post Graduate School.* Fourth edition. F. A. Davis Co., Philadelphia, 1931. Price, \$2.75

This seems to a rather unfortunate publication, now in its fourth edition. It consists largely of a list of diets, one for each disease and each type of patient.

Part I contains dietaries for adults in health and disease; Part II contains dietaries for infants and children in health and disease.

It is the sort of book used by physicians who are either so busy or so indifferent to the subject of nutrition that they must rely on an empirical compend for their information on diets.

Such a book may serve a considerable useful purpose; again, it may do definite harm in many instances.

It is quite cheaply printed.

FUNDAMENTALS OF DERMATOLOGY, by *Alfred Schalek, M. D., Professor of Dermatology and Syphilology, University of Nebraska College of Medicine, etc.* Second edition. Lea & Febiger, Philadelphia, 1931. Price, \$3

A compend on diseases of the skin. The first part of the book discusses in as concise and thorough manner as space permits the general symptomatology, diagnosis, etiology, and therapeutics. A list of helpful dermatological aphorisms is included in this section.

The second part of the book is devoted to the individual skin diseases, conveniently arranged in alphabetical order. The work is up to date, well illustrated, and the treatment of each disease is amply discussed when indicated. An ideal book for the busy practitioner.

RECENT ADVANCES IN RADIOLOGY, by *Peter Kerley, M. B., B. Ch. (N. U. I.), D. M. R. E. (Camb.), Assistant Radiologist, Westminster Hospital; Radiologist, The Royal Hospital for Diseases of the Chest.* P. Blakiston's Son & Co. (Inc.), Philadelphia, 1931

This is one of a series of books covering the important advances in various medical fields. It is really an elementary textbook of X-ray interpretation, though particular attention has been given to cholecystography, intravenous pyelography, and deep X-ray therapy. Practically nothing is given of technique or physics. The author has, however, attempted to correlate the pathological and the radiological findings, and while this is often somewhat difficult, he has in many cases succeeded well.

The illustrations are all remarkably fine and clear reproductions of the X-ray plates.

PRACTICAL ANESTHETICS, by *Charles F. Hadfield, M. B. E., M. A., M. D. (Camb.), Sen. Hon. Anesthetist, Prince of Wales's Hospital, etc.* Second edition. William Wood & Co., New York, 1931. Price, \$3.50

A handbook for medical and dental students and for the practitioner who desires to administer anesthetics and does not wish to use expensive or complicated apparatus.

In this edition the chapters on spinal anesthesia have been enlarged, and chapters on local and regional anesthesia and a special chapter on Local Anesthesia in Dental Practice have been added.

The author's aim has been to make the subject as practical as possible and to include all the small details so important in obtaining good results.

THE TREATMENT OF ASTHMA, by A. H. Douthwaite, M. D., F. R. C. P. (Lond.), Assistant Physician, Guy's Hospital; Physician in Charge of Massage Department, Guy's Hospital, etc. William Wood & Co., New York, 1931. Price, \$2.50

A small volume of 164 pages, discussing the etiology, symptoms, prognosis, and treatment of asthma.

Therapeusis occupies the major part of the text, in which, among other remedial measures, physiotherapy and vaccine therapy are thoroughly considered.

The author makes no claim to originality and quotes frequently from English and other European sources.

EYE, EAR, NOSE, AND THROAT FOR NURSES, by Jay G. Roberts, Ph. G., M. D., F. A. O. S., Licentiate, American Board Otolaryngology; Chief of Staff, Eye, Ear, Nose, and Throat, Los Angeles, etc. F. A. Davis Co., Philadelphia, 1931. Price, \$2.25

A book written for the nurse in training and the graduate nurse who may be called on to assist the specialist in eye, ear, nose, or throat diseases.

The special features required in nursing these cases, handling of emergencies, assisting with operations, and the care of the delicate instruments used are discussed in detail.

The illustrations, particularly those of the instruments, and the appended list explaining the technical terms used are adequate for the purpose for which the book is intended.

DISEASES OF THE TONGUE, by Walter G. Spencer, M. S., F. R. C. S., Consulting Surgeon, Westminster Hospital and Stanford Cade, F. R. C. S., Assistant Surgeon, Westminster Hospital Surgeon, Mount Vernon Hospital. Third edition of *Butlin's Diseases of the Tongue*. P. Blakiston's Son & Co., Philadelphia, 1931

If we are still to identify this book with Butlin's first edition, it is now getting pretty well along in years. Thirty years have passed since the appearance of the second edition by Butlin and Spencer. The present authors, Spencer and Cade, state that "the skeleton of the book remains the same." This statement contains much truth, for, indeed, the skeleton does remind one of the patterns of the medical monographs of the eighties.

The authors admit a doubt as to the wisdom of writing a book on this subject, and devote two or three pages of their preface to a support of their decision that such a book should be written.

Although much, perhaps most, of the content of the book would seem to fit more naturally into general works on surgery, medicine, or dermatology, the detailed knowledge here presented on cancer of the tongue and its treatment by radiation not only gives the

book an excuse for existence but makes it a book of unquestioned value.

The authors' attitude toward radium therapy in tongue cancer is to be admired, and is well stated:

Its possibilities are exaggerated, its pitfalls underestimated, and the medical literature as well as the lay press offer constant examples of unreasonable claims and unjustifiable statements. It is, however, as cruel and misleading to deprecate as to exaggerate the usefulness of this very delicate weapon, which, in careful hands, controlled by minds unbiased by prejudice, "cures" a selected few, relieves a great many, and robs no one from the benefits of excisional surgery.

CHEMISTRY FOR NURSES, by *Harry C. Biddle, A. M., Instructor in Chemistry, School of Nursing, Western Reserve University, etc.* F. A. Davis Co., Philadelphia, 1931. Price, \$2.75

A practical guide for the instructor and the student. There is sufficient material for at least a 45-hour course and the text is so outlined that it may be amplified should more time be available.

Each chapter, in addition to discussing the subject under consideration, gives topics for oral and written work and numerous questions to stimulate the interest of the student.

The illustrations are numerous and appropriate and the appendix contains lists of chemicals and apparatus required for the course.

DIABETES, ITS TREATMENT BY INSULIN AND DIET, by *Orlando H. Petty, A. M., M. D., F. A. C. P., Professor of Diseases of Metabolism, Graduate School of Medicine, University of Pennsylvania, etc.* Fifth edition. F. A. Davis Co., Philadelphia, 1931. Price, \$2

This little volume, now in its fifth edition, has been thoroughly revised and enlarged. The dietary and insulin control of diabetes and the hygiene of the diabetic are discussed in a particularly thorough manner.

The diet tables have been brought up to date and diets for those of the orthodox Jewish faith have been added.

While primarily intended as a practical handbook for the patient, the general practitioner will find it most useful.

Naval medical officers will recall that Doctor Petty, as a member of the Medical Corps, United States Navy, during the World War, was awarded the congressional medal of honor and several other highly coveted decorations.

THE INTERNATIONAL MEDICAL ANNUAL, 1931. William Wood & Co., New York, 1931. Price, \$6

This International Annual, although based on the medical literature of many nations, is compiled entirely by British physicians.

In the section on abdominal surgery there are references to 54 American papers, 32 British, 22 German and Austrian, 15 French, 5 Italian, and 15 papers from 8 other countries.

The subjects which have received particular notice are: Undulant fever, leg ulcers, epilepsy, colitis, high arterial tension, alcoholism and drug addition, anorexia, the leukemias, allergic phenomena, vascular surgery, conjunctivitis, new X-ray diagnostic methods, and electrotherapeutics.

ABDOMINAL PAIN, by John Morley, Ch. M., F. R. C. S., *Honorary Assistant Surgeon, Manchester Royal Infirmary; Honorary Consulting Surgeon, Ancoats Hospital, etc.* William Wood & Co., New York, 1931. Price, \$3.50

A discussion of the theories of pain in acute abdominal disorders. The prevalent theories are criticized as physiologically unsound and failing to conform with clinical facts.

As an alternative, a new theory is offered for the phenomena of deep and superficial pain and muscular rigidity, so commonly associated with acute abdominal disease.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION, Edited by Mrs. Maud H. Mellish-Wilson, Richard M. Hewitt, B. A., M. A., M. D., and Mildred A. Felker, B. S. Volume XXII, 1930. W. B. Saunders Co., Philadelphia, 1931

Of the 482 papers written in 1930, the editors selected 85 to be reprinted in full. Thirty others are abridged, 55 are abstracted, and 312 given by title only. The aim of this, as well as the preceding 21 volumes, has been to select material which would meet the requirements of the general practitioner, diagnostician, and general surgeon.

STREPTOCOCCIC BLOOD STREAM INFECTIONS, by George E. Rockwell, M. A., M. D., *Associate Professor of Bacteriology, College of Medicine, University of Cincinnati, etc.* The Macmillan Co., New York, 1931

A small volume, consisting of 69 pages, correlating in a concise, readable manner the laboratory and clinical management of streptococcic blood stream infections.

The chapter on treatment, which discusses the use of vaccines, sera, and measures to combat acidosis, will be found useful.

The author is of the opinion that the use of mercurochrome, gentian violet, and similar substances produce no beneficial results—in fact, may actually cause harm—and gives his views in the appendix.

HEMORRHOIDS, THE INJECTION TREATMENT AND PRURITUS ANI, by Laurence Goldbacher, M. D. Second edition. F. A. Davis Co., Philadelphia, 1931. Price, \$3.50

The first edition of this book appeared last year and was reviewed in the April, 1930, *BULLETIN*. The remarks made in that review

apply quite as well to this edition, namely, that the matter could have been presented in half the space, and that the book amounts to little more than two first-class medical journal articles.

The appearance of this new edition so close upon the heels of the previous edition must speak for the importance of the subject and the merits of the treatment described rather than for any particular merit of the book.

AN INTRODUCTION TO GYNECOLOGY, by *C. Jeff Miller, M. D., Professor of Gynecology, Tulane University School of Medicine, New Orleans, etc.* The C. V. Mosby Co., St. Louis, 1931. Price, \$5

A book intended for students beginning a course in gynecology. Only the fundamentals of the subject are dealt with. The text is arranged in 16 sections to meet the requirements of the usual junior course.

As therapy is not considered appropriate for the beginner and could only be briefly given in a book of this size, it has been omitted.

The text consists of 327 pages, and the 117 illustrations have been selected with care.

THE DIVISION OF PREVENTIVE MEDICINE

Capt. W. H. BELL, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

THE NAVY FROM THE INSURANCE ASPECT¹

By C. E. RIGGS, Surgeon General, United States Navy

The value of different points of view to a searching study of the problems inherent in the time-honored and, as Pearl (1) says, "naïvely called" enterprise of "life insurance," and the newer undertaking of disability insurance was given pointed recognition by Dr. William Muhlberg (2) when he outlined the separate though coordinated fields of investigation represented by the Association of Life Insurance Medical Directors and the medical section of the American Life Convention, together with the differing psychological and general approach to the subject characteristic of each. The principle involved in justification of the distinct existence and labors of these two organizations complementary to each other is given further recognition in the invited presence on your program to-day of those three Government services which, as a whole or as a basic part of their institutional function, are specifically concerned with human health in the broadest implication of the term, and which are conditioned to pursue that concern to any required extent.

The Navy has distinguishing features in respect to the question of morbidity and mortality which are generally influential in determining insurability. These may be appropriately introduced before the statistical matter is offered. Generally speaking, the insuring group in the Navy is its officer class, and this is the range of personnel which will be treated statistically for your information, although it shares in modified degree only the conditions and circumstances by which all naval personnel are surrounded. Such modification is, however, in the direction of reduced exposure on the one hand and of greater individual self-care on the other, plus the heightened supervision of habits and physical condition naturally given a relatively small and leading group having permanent identification with the service.

In the sense in which we are speaking and from the point of view of Government interest alone, persons of the above special group represent what may be termed preferred risks by virtue of the method

¹ Read at twenty-first annual meeting, medical section, American Life Convention, Washington, D. C., May 21, 1931.

of their selection for enrollment. A primary obligation rests upon the examiner or board of examiners to protect the Government against undue liability in judging the physical eligibility of candidates, just as an obligation rests upon the agent and medical examiner to protect the insurance company. In other words, they are quite as definitely first-class selections as those accepted by insurance companies because of determined physical fitness. Moreover, the initial advantage is given persistence and support by a close follow up. An increasing humanitarian motive has entered into the relationship of employer and employed everywhere and is reaping reward in practical form, but for economic reasons which express themselves definitely in terms of dollars and cents all employers with any imagination and discernment have ever been desirous to hold impaired efficiency and the noneffective rate of employees at the lowest figure possible. The difference between the past and present in this important matter since the acceptance and practice of the principle of the conservation of human energy in enterprise is that greater knowledge and trained intelligence are now backing it.

The Government of the United States in the Navy, as in its sister services, is especially concerned and constantly watchful to prevent loss through excessive temporary and permanent disabling morbidity or injuries and death. It is essentially an institution for emergent service and its available man power must be kept as near 100 per cent as possible. The responsibility of the naval surgeon is primarily hygienic and what he strives for is "positive health."

In this connection it is interesting to consider the following table of rates for the calendar years 1915 to 1929, inclusive, which shows the daily average of sick for the entire Navy and that for different groups pertinent to the discussion, calculated separately.

TABLE I.—Noneffective rates or per cent of personnel constantly on sick list

Year	Entire Navy	Apprentice seamen only	Entire Navy, exclusive of apprentice seamen and officers	Officers, Navy and Marine Corps	Entire Navy, exclusive of officers
	(1)	(2)	(3)	(4)	(5)
1915.....	3.12	7.60	3.51	2.65	3.15
1916.....	3.20	5.29	3.14	2.34	3.26
1917.....	2.18	8.35	1.97	1.09	2.25
1918.....	3.44	6.40	3.36	2.22	3.51
1919.....	4.06	7.52	3.97	2.95	4.14
1920.....	4.11	7.45	3.82	2.91	4.24
1921.....	3.45	5.84	3.34	2.90	3.49
1922.....	3.13	6.74	3.10	2.43	3.18
1923.....	3.47	8.94	3.32	2.64	3.54
1924.....	3.03	5.79	3.02	2.17	3.10
1925.....	2.89	4.92	2.85	2.45	2.93
1926.....	3.06	6.11	2.67	2.39	3.12
1927.....	3.21	7.52	2.96	2.43	3.28
1928.....	3.22	7.53	3.34	2.57	3.28
1929.....	3.10	6.79	3.03	2.43	3.16
1930.....					
Median rate.....	3.19	6.77	3.14	2.43	3.26

Columns 2 and 3 of Table I are useful in comparing the two gross stages of physical condition in the naval service, expressing the degree of resistance to disease brought to the Navy from civil life in one and that realized as a result of its hygienic influence in the other. The first is represented by apprentice seamen who are first enlistment recruits under training for about three months; the second by the seasoned personnel. The difference between the rate for the Navy other than officers and that for officers (our insuring class) is also seen by comparing columns 4 and 5.

These rates can not be compared with any fairness to those for numerically equal civil populations of corresponding age, sex, occupation, and place characteristics for various reasons. Chief among these is that so-called "silent sickness" is rare and that naval personnel is entered and carried on the sick list (relieved from duty) for conditions which would not, at least immediately, lead to absence from work in civil life. Men in the Navy and Marine Corps can not be nursed along at their jobs and unless capable of full effort or full responsibility they are accounted for as sick. This practice has distinct advantages in all that is implied by the apprehension of disabling conditions early in their course, and it does in the long run reduce morbidity damage and mortality, but currently it increases the noneffective rate. Officers participate to a less extent in this practice with its consequent boosting of noneffective rate. With them it is made unnecessary by the nature of their duties and living provisions and by the fact that they are more directly under the eye of the medical officer, who to all intents and purposes is a family physician, having acquaintance with the bodies, personalities, and reactions of his clientele. It is this preventive supervision, or the better condition, or the relatively limited exposure, or the circumstances favorable to carrying on under treatment, or a combination of the four factors which explains the lower noneffective rate of officers (column 4) as compared with the rest of the Navy (column 5).

It may be noted as a striking indication of the promptly developing stamina incident to naval service that the noneffective rate of apprentice seamen (column 2) is more than twice the figure for all personnel including apprentice seamen (column 1). The parallel of factors is more accurate and the difference even greater when comparison is made between the noneffective rate of apprentice seamen (column 2) and that of Navy personnel, exclusive of apprentice seamen and officers (column 3). In other words, the benefit of service life with all that that means in the way of wholesome living and protection against morbid influences finds some expression in these facts. It is also interesting in this connection to note that at the Naval Academy, which is the cradle of the greater per

cent of officer personnel, the increase of weight as a single important criterion of developed physical vigor and of physiological normalcy has averaged $4\frac{1}{2}$ pounds per person the first year of service for the past four years. The median noneffective rate of midshipmen for the past 10 years is 2.26—less than that for officers. This is in spite of the immunizing processes and need for adjustment to which the fourth-class midshipmen are exposed.

Not only is the determination of physical and mental qualification for admission rigid, but upon admission steps are taken to build up normal resistance to its highest point and maintain it there by hygienic measures and to fortify resistance in special directions by specific immunizing procedures. These are repeated at more or less regular intervals and on pointed occasions. For example, revaccination is the invariable practice in the presence of smallpox and cholera, vaccine is administered when exposure to the disease is likely, as on the Asiatic Station. One is always party to the benefits of trained sanitary surveillance of group environs and contacts, is subject to constant interested physical supervision and periodic examination, and is entitled to and receives prompt and solicitous care when disabled by illness or otherwise.

Acute conditions are usually quickly apprehended and "early diagnosis, the essential so often missing in the fight against" or for the control of chronic degenerative processes, such as nephritis, heart disease, diabetes, tuberculosis, cancer, and other diseases of adult life, is usually possible. At least the absence of opportunity for an early diagnosis is not a large factor in our failure to make it. As an outstanding condition in which the time factor is important, appendicitis may be mentioned. In 12,204 cases (all operated) there were 125 deaths, or a mortality rate of 1 per cent; 4,329 of these were chronic with 9 deaths, or a rate of 0.2 per cent, and 7,875 were acute with 116 deaths, or a mortality rate of 1.4 per cent.

Moreover, throughout one's career besides the influence of the intelligence of the class concerned there is the ever-present incentive to a more nearly correct régime of life in the knowledge that physical fitness is a condition precedent to seniority advancement in the lower grades and to advancement by preferment in the upper grades. Mental attitude and state of mind, as well as physical susceptibility and exposure, figure importantly in the appraisal of disability chances and of the life span, and this again seems to place the insuring group of the Navy in the preferred class. Life in the Navy does not, on the whole, expose to the incessant fundamental wear and tear of business stress and grind and economic anxiety common to a corresponding group in civil life, and the hazards ordinarily pictured as attaching to careers in military serv-

ice, whether in the process of training or actual belligerent activity, do not fully materialize or entirely offset the initial advantages above outlined as establishing a preferred status.

The life extension of health conservation idea which fills so large a place in the plans of health departments and insurance companies and other similarly purposed organizations really originated in the practice of military institutions. Periodic physical examination is a custom of long standing with them. The direct definite ascertainment of the state of health and physical condition of all officers is now a formal annual affair and has been for over 20 years. It is not optional or a matter of individual initiative or persuasion or appeal to reason or enticement. The last-named recourse is represented by the offer of certain English companies to reduce the premium of those insured who take advantage of the life extension examination system. In the Navy it is an obligation closely checked to ascertain conformity.

Within the period of the history of these annual examinations the details of the procedure have undergone various changes, but the basic idea of health conservation embodied in the required standard of physical fitness has always prevailed and the health promoting value of exercise for the body and of recreation for the mind has never been lost sight of. When inaugurated in 1908 by President Roosevelt in consultation with the then Surgeon General of the Navy, P. M. Rixey, it was associated with an annual physical test to determine capacity for definite physical effort as a criterion of eligibility for active duty. Indeed, the physical test was the principal factor at that time and the examination before and after only incidental, albeit a necessary and important accompaniment. Since then dominant interest has swung to the examination side and increased cognizance has been taken of minor defects with a view through advice and prompt attention to their correction and the prevention of major conditions. This change was effected through the action of Surg. Gen. E. R. Stitt who, during his administration beginning in 1920, made great advances toward perfecting the technique and thoroughness of the system. His innovation, known as the Habit and Complaint Chart (confidential), though of real value, has not survived for various reasons, but otherwise the annual examination of all officers continues on the plane to which he elevated it.

These examinations are conducted by boards of medical officers, which wherever possible include specialists, and, with the existing general enlightenment as to their importance from the standpoint of conservation of officer personnel, are searching in nature. Although the call for subjective symptoms is not now direct, the habit of inquiry is too much a matter of second nature in the profession to be

neglected and complaint is too much a matter of human nature to fail of results helpful to the primary purpose of the examination, which is the individual's present and future welfare. The habit information is less likely to be elicited except in direct consequence of occasion to correct some discovered defect.

The conditions among officers of greatest importance in respect to health advice are overweight; arterial hypertension; eye, ear, nose, and throat defects; focal infections; postural abnormalities; and renal and cardiac dysfunctions.

Tables II and III display the conditions found at annual physical examinations, 1926 to 1930, inclusive. The number of examinations is 47,776.

TABLE II.—*Annual rate per 1,000, officers (Navy and Marine Corps), for all defects, 1926–1930, inclusive, according to class of disease and condition*

Class of defects (in order of frequency)	Number	Annual rate per 1,000
Diseases of eye and adnexa.....	9,402	196.79
Dental diseases and conditions.....	7,688	160.92
Diseases of ear, nose, and throat.....	7,615	159.39
Miscellaneous diseases and conditions.....	7,590	158.87
Diseases of circulatory system.....	2,072	43.37
Diseases of the digestive system.....	1,433	29.99
Diseases of genito-urinary system (nonvenereal).....	733	15.34
Herniae.....	523	10.95
Diseases of the motor system.....	511	10.70
Diseases of the skin, hair, and nails.....	475	9.94
Parasites (fungi and certain animal parasites).....	278	5.82
Tumors.....	131	2.74
Diseases of the respiratory system.....	77	1.61
Venereal diseases.....	68	1.42
Diseases of the nervous system.....	48	1.00
Diseases of the ductless glands and spleen.....	31	.75
Diseases of the mind.....	22	.46
Injuries.....	13	.27
Communicable diseases transmissible by oral and nasal discharges.....	7	.15
Tuberculosis (all forms).....	3	.06
Diseases of the lymphatic system.....	2	.04
Diseases of the blood.....	2	.04
Communicable diseases transmissible by insects and other arthropods.....	1	.02
Other diseases of infective type.....	1	.02
Total, all classes.....	38,726	810.57

TABLE III.—*Annual rate per 1,000 officers (Navy and Marine Corps), 1926–1930, inclusive, showing special defects worthy of note having a rate of more than 1 per 1,000*

Defects (in order of frequency)	Number of officers showing condition	Rate per 1,000 of officers showing condition
Error of refraction.....	8,519	178.31
Corrected with lenses.....	6,317	132.22
Not corrected with lenses.....	2,202	46.09
Overweight.....	5,207	108.99
Less than 20 per cent.....	3,487	72.99
20 per cent or more.....	1,722	36.04
Defective hearing.....	3,102	64.93
Bilateral.....	1,571	32.88
Unilateral.....	1,531	32.05
Pyorrhea alveolaris and gingivitis.....	3,031	63.44
Deviation, nasal septum.....	2,472	51.74
Hypertension (over 150 mm. Hg.).....	1,646	34.45
Hemorrhoids.....	1,308	27.38

TABLE III.—*Annual rate per 1,000 officers, etc.—Continued*

Defects (in order of frequency)	Number of officers showing condition	Rate per 1,000 of officers showing condition
Tonsillitis, chronic.....	742	15.53
Defective color perception.....	698	14.61
Degree not stated.....	514	10.76
Marked.....	106	2.22
Slight.....	78	1.63
Herniae.....	522	10.93
Inguinal.....	402	8.41
All others.....	120	2.51
Varicocele.....	328	6.87
Tachycardia.....	292	6.11
Albuminuria.....	289	6.05
Varicose veins.....	275	5.76
Trichophytosis.....	261	5.46
Flat foot.....	233	4.88
Acne.....	144	3.01
Sinusitis.....	134	2.80
Cardiac arrhythmia, extra systole.....	127	2.66
Rhinitis, hypertrophic.....	114	2.39
Hydrocele.....	106	2.22
Ankylosis.....	93	1.95
Psoriasis.....	91	1.90
Eczema.....	90	1.88
Valvular heart disease.....	88	1.84
Glycosuria.....	81	1.70
Otitis, media, chronic.....	79	1.65
Syphilis.....	63	1.32
Cardiac disorder, functional.....	55	1.15
Cyst.....	54	1.13
Pharyngitis, chronic.....	53	1.11
Dermatitis, seborrheica.....	51	1.07

It is seen that all classes of disease are represented in the total defects noted in the annual examinations, but the list of individual diseases is too long and their rate too small to justify detailed consideration of the record in a paper of this length. Suffice it to say that benefit is accruing to both the officers and the Government through the operation of the triplex—discovery of defects, advice, corrective measures.

Many of the defects noted are not directly interesting from the public health or insurance point of view. They are primarily items which operate to impair individual fitness and depress that high standard of general efficiency and productivity which must obtain in military institutions. Notable among such defects are errors of refraction and defective color perception and in large part also defective hearing. Overweight, next to errors of refraction, involves the greatest number of officers, but the last word has not been said on the relation of moderate variations from the arbitrary weight per height per age scale to health. Extensive studies have been made and a great deal has been written on the subject of overweight and underweight, including the consideration of hereditary influences, and reasonable latitude and intelligent allowances must be made. Twenty per cent may constitute a rational dividing line in overweight as a basis for judgment in individual cases. We can not lightly tamper with what, all things considered, seems to be a physiological tendency without the risk of jeopardizing proper

resistance to disease. As Stitt (3) has said, "It is sudden gains or losses in weight of any individual that count, rather than variations from standard averages." In the examinations held in 1925 the importance of overweight is indicated by the fact that the per cent of hypertension among officers in the overweight class was three times as great as the average rate of all officers (3). Extra burden on the heart, blood vessels, and kidneys seems to be the particular offense of overweight, and various statistical studies show that the diseases which are on the increase, such as heart and arterial disease, cerebral hemorrhage, nephritis, and diabetes, etc., have a higher incidence among the fat (4). The broadly proclaimed increase of these diseases, however, is not true of the Navy, as shown by Table IV.

TABLE IV

	Rate per 1,000, entire Navy				
	1925	1926	1927	1928	1929
Diseases of circulatory system.....	3.53	3.30	3.19	3.05	.301
Nephritis.....	.66	.68	.69	.76	.77
Cerebral hemorrhage.....	.04	.01	.01	.03	.03
Diabetes.....	.16	.25	.16	.20	.15

Available data concerning hypertension cases are not sufficient to classify them for a 5-year period. A 1-year record of segregation by degree may be helpfully suggestive, however, and in 1930 we find the following:

Slight, 150-165 mm. Hg.....	245
Moderate, 165-180 mm. Hg.....	61
180-199 mm. Hg.....	49
Over 200 mm. Hg.....	12

Nine of the highest degree hypertension are definitely classified as arteriosclerotic; the other three may or may not classify as nephritic and if not are, in all probability, to be classified as essential. Certainly the great balance of cases (slight and moderate plus) of this condition comes in the essential classification, without determinable or fixed cause and without associated symptoms or signs. As in the matter of overweight, there is much still to be learned about the cause and meaning of essential hypertension, the hyperpiesia of Sir Clifford Allbutt, but according to Dr. David Riesman (5), while "high blood pressure is not a bodily virtue" (he is referring to essential hypertension), it is not per se necessarily threatening except in the young. This observation seems to be at variance with insurance experience, which indicates that "even slight elevations of blood pressure are accompanied by excessive mortality" (2).

We are lacking in "definite standardized conclusions as to the significance and control" (3) of many prominent defects, but as in the case of overweight and hypertension, with due regard for the many productive factors, they are often enough due to dietetic and other indiscretions to come within the range of timely control. Even the effects of the pressure and strain incident to the circumstances and conditions of the modern Navy are not beyond beneficial modification or counterbalance, and opportunities for relaxation, diversion and open-air interests and exercise are provided throughout the service.

From the purely actuarial point of view specific causes of death or number of deaths by specific causes, though required and important, are of less immediate moment than rate of death for different age periods in no more detail as to cause than a general distinction between disease and injury. Table V presents these data for the Navy in respect to both active and retired lists.

TABLE V.—*Death rates, by age groups, officers of the United States Navy and Marine Corps, for the 5-year period 1925-1929, inclusive*

ACTIVE

Age group	Number in group	All diseases		Injuries and poisoning		All causes	
		Deaths	Rate per 1,000	Deaths	Rate per 1,000	Deaths	Rate per 1,000
20-24.....	5,732	3	0.52	16	2.79	19	3.31
25-29.....	10,034	7	.70	57	5.68	64	6.38
30-34.....	9,683	13	1.34	38	3.92	51	5.27
35-39.....	9,055	22	2.43	27	2.98	49	5.41
40-44.....	7,465	14	1.88	18	2.41	32	4.29
45-49.....	4,177	28	6.70	9	2.15	37	8.86
50-54.....	1,975	16	8.10	1	.51	17	8.61
55-59.....	819	14	17.09	0	0	14	17.09
60-64.....	264	7	26.52	1	3.79	8	30.30
Over 64.....	6	2	333.33	0	0	2	333.33
All ages.....	49,210	126	2.56	167	3.39	293	5.95

RETIRED

Age group	Number in group	Deaths	Rate per 1,000	Deaths	Rate per 1,000	Deaths	Rate per 1,000
20-24.....	5	0	0	0	0	0	0
25-29.....	246	3	12.20	1	4.07	4	16.26
30-34.....	677	12	17.73	2	2.95	14	20.68
35-39.....	792	15	18.94	2	2.53	17	21.46
40-44.....	984	7	7.11	1	1.02	8	8.13
45-49.....	1,018	17	16.70	1	.98	18	17.68
50-54.....	1,344	35	26.04	0	0	35	26.04
55-59.....	1,163	32	27.52	0	0	32	27.52
60-64.....	621	25	40.26	1	1.61	26	41.87
65-69.....	646	18	27.86	1	1.55	19	29.41
70-74.....	438	26	59.36	0	0	26	59.36
75-79.....	272	40	147.06	0	0	40	147.06
80-84.....	173	25	144.51	1	5.78	26	150.29
85-89.....	64	13	203.13	0	0	13	203.13
Over 89.....	21	6	285.71	0	0	6	285.71
All ages.....	8,464	274	32.37	10	1.18	285	33.67

Table VI presents a rearrangement of deaths according to the broad classification of diseases and injuries and Table VII according to leading specific causes in order of relative importance.

TABLE VI.—Deaths among officers, Navy and Marine Corps (active and retired), for the 5-year period 1925–1929, arranged according to class and annual rate per 1,000 for active officers

Number of officers.....	Active		Retired	
	49,210		8,464	
Class	Deaths	Rate per 1,000	Deaths	Rate per 1,000
Diseases of the circulatory system.....	38	0.77	127	15.00
Communicable diseases transmissible by oral and nasal discharges.....	19	.39	29	3.43
Diseases of the digestive system.....	18	.37	15	1.77
Tumors.....	17	.35	23	2.72
Diseases of the genito-urinary system.....	10	.20	17	2.01
Tuberculosis (all forms).....	5	.10	22	2.60
Venereal diseases (syphilis).....	5	.10	2	.24
Diseases of the ear, nose, and throat.....	2	.04	0	0
Diseases of the motor system.....	2	.04	1	.12
Diseases of the nervous system.....	2	.04	21	2.48
Miscellaneous diseases and conditions.....	2	.04	3	.35
Communicable diseases transmissible by insects and other arthropods.....	2	.04	2	.24
Diseases of the ductless glands and spleen.....	1	.02	5	.59
Diseases of the blood.....	1	.02	0	0
Diseases of the lymphatic system.....	1	.02	0	0
Other diseases of infective type.....	1	.02	1	.12
Diseases of the mind.....	0	0	1	.12
Diseases of the respiratory system.....	0	0	1	.12
Drowning.....	41	.83	0	0
Other accidents and injuries.....	120	2.44	14	1.65
Poisonings.....	6	.12	1	.12
Total.....	293	5.95	285	33.67

TABLE VII.—Deaths among officers, Navy and Marine Corps (active and retired), for the 5-year period 1925–1929, arranged according to leading specific cause in order of relative importance

Number of officers.....	Active			Retired		
	49,210			8,464		
Cause	Order of frequency	Deaths	Rate per 1,000	Order of frequency	Deaths	Rate per 1,000
Myocarditis, chronic.....	(1)	21	0.43	(1)	48	5.67
Pneumonia, lobar.....	(2)	10	.20	(8)	9	1.06
Influenza.....	(3)	6	.12	(11)	5	.59
Nephritis, chronic.....	(4)	6	.12	(7)	13	1.54
Arteriosclerosis, general.....	(5)	5	.10	(2)	46	5.43
Tuberculosis (all forms).....	(6)	5	.10	(3)	22	2.60
Syphilis.....	(7)	5	.10	(27)	2	.24
Appendicitis, acute.....	(8)	4	.08	(21)	2	.24
Ulcer, duodenum.....	(9)	4	.08	(20)	2	.24
Angina pectoris.....	(10)	3	.06	(5)	15	1.77
Cholecystitis.....	(11)	3	.06	(29)	1	.12
Glioma, brain.....	(12)	3	.06	(44)	1	.12
Endocarditis, acute, ulcerative.....	(13)	2	.04	(18)	2	.24
Valvular heart disease, combined lesions, aortic and mitral.....	(14)	2	.04	-----	0	0
Gastritis, acute.....	(15)	2	.04	(28)	1	.12
Gallstones.....	(16)	2	.04	(31)	1	.12
Cirrhosis, liver.....	(17)	2	.04	(10)	5	.59
Pneumonia, broncho.....	(18)	2	.04	(6)	15	1.77
Carcinoma, colon.....	(19)	2	.04	-----	0	0
Pyelonephritis.....	(20)	2	.04	-----	0	0
Alcoholism, chronic.....	(21)	2	.04	(53)	1	.12

TABLE VII.—Deaths among officers, Navy and Marine Corps, etc.—Continued

Cause	Active			Retired		
	Order of frequency	Deaths	Rate per 1,000	Order of frequency	Deaths	Rate per 1,000
Number of officers.....		49,210			8,464	
Abcess, retropharyngeal.....	(22)	2	.04		0	0
Endarteritis, left coronary artery.....	(23)	1	.02		0	0
Embolism, ileocolic.....	(24)	1	.02		0	0
Dilatation, cardiac, acute.....	(25)	1	.02	(13)	4	.47
Endocarditis, acute, malignant.....	(26)	1	.02		0	0
Thrombosis, coronary artery.....	(27)	1	.02		0	0
Pancreatitis.....	(28)	1	.02		0	0
Smallpox.....	(29)	1	.02		0	0
Carcinoma:						
Tongue.....	(30)	1	.02		0	0
Kidney.....	(31)	1	.02		0	0
Sigmoid.....	(32)	1	.02	(37)	1	.12
Liver.....	(33)	1	.02	(23)	2	.24
Liver and intestines.....	(34)	1	.02		0	0
Testicle.....	(35)	1	.02		0	0
Lung.....	(36)	1	.02		0	0
Epithelioma:						
Ear.....	(37)	1	.02		0	0
Tongue.....	(38)	1	.02		0	0
Sarcoma, ileum.....	(39)	1	.02		0	0
Myeloma, multiple.....	(40)	1	.02		0	0
Lymphoma, general.....	(41)	1	.02		0	0
Calculus, ureter.....	(42)	1	.02		0	0
Nephritis, acute.....	(43)	1	.02		0	0
Osteomyelitis, mandible.....	(44)	1	.02		0	0
Arthritis, acute.....	(45)	1	.02		0	0
Abscess, brain.....	(46)	1	.02		0	0
Hemorrhage, brain.....	(47)	1	.02	(4)	17	2.01
Typhoid fever.....	(48)	1	.02		0	0
Malaria.....	(49)	1	.02		0	0
Diabetes, mellitus.....	(50)	1	.02	(12)	5	.59
Hodgkin's disease.....	(51)	1	.02		0	0
Leukemia.....	(52)	1	.02		0	0
Cellulitis, leg.....	(53)	1	.02		0	0
Carcinoma, stomach.....		0	0	(9)	6	.71
Valvular heart disease, aortic insufficiency.....		0	0	(14)	3	.35
Endocarditis, chronic.....		0	0	(15)	3	.35
Aneurysm, aorta.....		0	0	(16)	2	.24
Valvular heart disease, mitral insufficiency.....		0	0	(17)	2	.24
Myocarditis, acute.....		0	0	(19)	2	.24
Hypertrophy, prostate.....		0	0	(21)	2	.24
Carcinoma:						
General.....		0	0	(22)	2	.24
Bladder.....		0	0	(24)	2	.24
Intestines.....		0	0	(25)	2	.24
Meningitis, cerebrospinal.....		0	0	(26)	2	.24
Cholangitis, chronic.....		0	0	(30)	1	.12
Peritonitis, general, acute.....		0	0	(32)	1	.12
Intestinal obstruction from external causes.....		0	0	(33)	1	.12
Hemorrhage, bladder.....		0	0	(34)	1	.12
Prostatocystitis.....		0	0	(35)	1	.12
Carcinoma:						
Gall bladder.....		0	0	(36)	1	.12
Prostate.....		0	0	(38)	1	.12
Pancreas.....		0	0	(39)	1	.12
Throat.....		0	0	(40)	1	.12
Sarcoma, neck.....		0	0	(41)	1	.12
Epithelioma:						
Neck.....		0	0	(42)	1	.12
Ear and mastoid.....		0	0	(43)	1	.12
Encephalitis, chronic.....		0	0	(45)	1	.12
Epilepsy, Jacksonian.....		0	0	(46)	1	.12
Dementia, paralytic.....		0	0	(47)	1	.12
Dysentery, entamebic.....		0	0	(48)	1	.12
Tularemia.....		0	0	(49)	1	.12
Edema, lung.....		0	0	(50)	1	.12
Arthritis, spine.....		0	0	(51)	1	.12
Septicemia.....		0	0	(52)	1	.12
Alcoholism, acute.....		0	0	(54)	1	.12
Senility.....		0	0	(55)	1	.12
Drowning.....		41	.83		0	0
Other accidents and injuries.....		120	2.44		14	1.65
Poisonings.....		6	.12		1	.12
Total.....		293	5.95		285	33.67

The increased longevity observed and recorded by statisticians has resulted principally from diminished mortality in the premid-life period, so that there is now a greater portion of the population in which advanced stages of chronic degenerative processes may develop. The movement for life-extension examinations has its root in this observation, and whether attributable to life in the Navy or annual physical examination, or both, the fact remains that the Navy compares favorably with the United States death registration area and actuarial record in the matter of death from certain representative members of this group of diseases as well as diseases in general. Table VIII shows this.

TABLE VIII.—*Per cent of deaths, 1920-1926 (6)*

Disease	Registration area, United States	Actuarial	Officers, Navy and Marine Corps
Tuberculosis.....	14.2	8.5	5.3
Heart disease.....	12.2	7.0	11.7
Nephritis.....	6.6	3.8	3.2
Diabetes.....	1.8	.7	.9

Of the 88 cases of heart disease constituting the 11.7 per cent of the above table, 24 were on the active list and 64 on the retired list. Forty-nine of these 64 cases were over 64 years, divided into age groups as follows:

Heart disease (organic)

Age group:	Deaths
64.....	5
65-69.....	8
70-74.....	10
75-79.....	13
80-84.....	8
85-89.....	4
90-94.....	1

In this connection it is highly suggestive that according to Admiral Snow (7) the mortality experience of the Navy Mutual Aid Association, involving over 6,000 members, is only about 70 per cent of the American Experience Table. This would appear to be expected in view of the fact that only the age group under 35 years is eligible and that the physical condition of applicants is investigated to determine acceptability just as by all other insuring organizations. In the Navy, therefore, this seems a sort of superselection by examination, but actually membership is what it is by limit of timely application rather than by exclusion because of defect and the examination is a form or a check, if you will, rather than a necessary instrument. Within the age period eligibility for membership in-

cludes regular officers of the Navy, Marine Corps, and Coast Guard, either active or retired and reserve officers of these three services in active, inactive, or retired status. The mortality experience boasted by the Navy Mutual Aid Association can not be attributed to this reexamination of the previously determined fit, but to that previously determined fitness and all the circumstances surrounding officers.² The membership is subject to all types of exposure as one would expect in the services concerned and no kind of special duty (submarine or aviation, etc.) is disqualifying. Tables IX and X show the mortality and rate per 1,000 of population incident to exposure in these two special branches.

TABLE IX.—*Submarine deaths*

Year	Enlisted personnel			Commissioned personnel		
	Average complement	Deaths	Rate per 1,000	Complement ¹	Deaths	Rate per 1,000
1921.....	2,231	3	1.34	252	0	0
1922.....	2,054	3	1.46	215	0	0
1923.....	2,200	7	3.18	242	0	0
1924.....	2,619	1	.38	266	0	0
1925.....	2,983	27	9.05	272	6	22.06
1926.....	3,018	5	1.66	282	0	0
1927.....	2,886	35	12.13	291	5	17.18
1928.....	2,915	0	0	298	0	0
1929.....	3,114	2	.64	340	0	0

¹ Number of officers attached to submarines as of Sept. 1, for years 1921 to 1929, inclusive, according to Navy directories.

TABLE X.—*Aviation deaths*

Year	Enlisted personnel			Commissioned personnel		
	Average complement	Deaths	Rate per 1,000	Complement	Deaths	Rate per 1,000
1921.....	780	23	29.49	472	16	33.90
1922.....	775	4	5.16	375	17	45.33
1923.....	857	9	10.50	359	10	27.86
1924.....	1,009	16	15.86	375	17	45.33
1925.....	790	16	20.25	451	15	33.26
1926.....	881	6	6.81	532	13	24.44
1927.....	799	11	13.77	555	16	28.83
1928.....	950	10	10.53	607	25	41.19
1929.....	997	11	11.03	708	11	15.54

Both of these fields of duty are constantly under consideration and intensive study from the aspects of safety in operation and recovery of those involved in accident. I need not nor have I time

² As shown by the Annual Report of the Surgeon General, United States Navy, for 1927, the death rates per 1,000 for the 5-year period 1921–1925, inclusive, for officers, Navy and Marine Corps, and white males in registration area, United States, are 9.85 and 14.65, respectively. In other words, the mean death rate per 1,000 for all ages among officers was 67 per cent of the corresponding population in the registration area. This figure is corroborative of the previously determined fitness rather than the reexamination in explanation of Navy Mutual Aid experience.

to discuss all the particular lines of study or measures adopted. It will suffice as interestingly indicative merely to mention experiments with chemicals to perfect the conditioning of air within submarines; the investigation and provision of facilities for raising helpless submerged submarines and the escape of those on board; the investigation of the CO content of air in the fuselage of aeroplanes as a possible depressant of the required alert consciousness of pilots; and the careful determination of psychological fitness, among other things, in qualifying candidates for flying. This is to say nothing of the constant improvement to the same end in machines and aeronautical instruments and the development of new safety devices. The importance and benefits of psychological determinations are discussed and graphically illustrated in an article by Dr. C. G. De Foney, United States Navy, in the Naval Medical Bulletin of April, 1931 (8). The relation of deaths to number of flights and flying hours in the Navy and Marine Corps is shown in Table XI.

TABLE XI.—*Ratio of deaths to number of flights and number of flying hours (commissioned and enlisted personnel)*

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Deaths per 1,000 flights.....	0.78	0.26	0.21	0.41	0.26	0.15	0.21	0.18	0.11
Deaths per 1,000 flying hours.....	.98	.40	.32	.69	.37	.21	.25	.18	.11

It will be noted that the general trend of deaths per flight and flying hours is downward and initial readings indicate that the rate of aviation fatalities will be lower in 1930 than "in any year since aviation became an important part of the program of naval activities." As against 39,346.75 flying hours in 1922, there were 203,197.95 in 1929.

When one comes to consider disability from the Navy point of view in relation to "sick insurance" a new factor is introduced into an already complicated problem and yet one which, by virtue of frank recognition, does not further complicate the problem. It is merely one more card on the table, and that card results from the difference between requirements in military service and civil life as regards residue of physical capacity after degree of impairment has been subtracted.

It is in connection with this department of insurance that morbidity rates are of value, and they have been partially supplied by Table I, which shows the noneffective rate of officers. These are the *total* temporary disabilities in the Navy as against what in many instances would be *partial* temporary disabilities in civil life. These and other total temporary disabilities in service practice may extend to partial permanent disability, which, depending upon degree and

classification, end as does total permanent disability in invaliding to the retired list. But when one is so retired it may mean, and in the vast majority of instances does mean, only that he has become unfit for active service in the sense of being unequal to the exposure, physical demands, and per cent efficiency of the standard average performance in run-of-the-mine assignments. This, of course, is in marked contrast to happenings in civil life, and you will frequently find retired officers engaging in productive enterprise, although retired pay is in a sense the expression of the currently discussed proposition of unemployment insurance.

It is in underwriting for disability benefits that the science and art of medical selection is emphasized. The personal equation (assessing the human element in the applicant) enters here more fully than it does in the selection of life risks. Those who keep at their daily tasks longer than they should to prevent prolonged illness when finally forced to give up and those who quickly give up without adequate reason represent the extremes. The tendency of the great majority lies between. In general, that of officers is to stick at their jobs. It is never convenient for them to be sick. But the danger of this tendency is largely compensated by the watchfulness of the medical officer and his ability, if need be, to force the officer on the sick list. Service personnel are subject to supervision in a manner and to an extent that does not obtain in civil life. Certainly there is not the question connected with budgeting to deter or defer appeal for medical advice that there is in civil life, where the cost of sickness is so disconcerting to a realization of the plans for health conservation and where patent medicines, quacks, and cults find wide acceptance.

In passing, I need only acknowledge recognition of the growth in moderate-pay clinics (9) to bring early diagnosis and treatment within the reach of all economic classes and to reduce the disparity in this respect, which in the past existed and to a modified extent still exists, between the resources in the Government services and in civil life. This movement toward health conservation is expressing itself in many ways and is being organized according to American genius. Wherever participated in by insurance companies, it is directly assisting their policy holders to continue to live. I suppose more than half of the insurance companies are thus serving their respective parts of the insured public, but in this the Navy is acting indirectly in the interests of all companies and at present probably doing it in more certain and effective fashion than the companies themselves.

Scientific insurance is based primarily upon mortality tables and the expectation of life which they show, first compiled and calculated by Haeley in 1693, and these in turn are based upon the law of

averages. But in order that the calculations of actuaries may not fail of their purpose and to be of value to the business, the advance guard in the selection of risks must be informed and alert. You, the junior association in the insurance field, I take to be the advance guard and as such are expected to show especial qualifications in the venture of disability underwriting. At least, it requires you to get closer to your potential risks and to learn the morbidity trend in various localities, occupations, and different sex and age groups, etc. The normal morbidity experience of the Navy and Marine Corps in its officer class according to the criterion of occasion for retirement, which can alone be of interest from the insurance point of view, is shown in Tables XII and XIII.

TABLE XII.—*Causes of retirement from active service by reason of physical disability, officers of the Navy and Marine Corps, arranged according to classes for the 5-year period 1925-1929*

	Number	Rate per 1,000
Tuberculosis (all forms).....	60	1.22
Diseases of the circulatory system.....	50	1.02
Diseases of the mind.....	46	.93
Diseases of the eye.....	33	.67
Diseases of the ear, nose, and throat.....	29	.58
Venereal diseases (syphilis).....	22	.45
Injuries.....	21	.43
Diseases of the digestive system.....	20	.41
Diseases of the nervous system.....	13	.26
Diseases of the ductless glands and spleen.....	12	.24
Diseases of the genito-urinary system (nonvenereal).....	11	.22
Diseases of the respiratory system.....	10	.20
Communicable diseases transmissible by oral and nasal discharges.....	6	.12
Other diseases of infective type.....	5	.10
Diseases of the blood.....	3	.06
Diseases of the motor system.....	3	.06
Herniæ.....	2	.04
Tumors.....	2	.04
Communicable diseases transmissible by intestinal discharges.....	1	.02
Total.....	349	7.09

TABLE XIII.—*Causes of retirement from active service by reason of physical disability, officers of the Navy and Marine Corps, arranged according to leading specific cause in order of relative importance for the 5-year period 1925-1929*

	Number	Rate per 1,000
Tuberculosis, pulmonary, chronic, active.....	53	1.08
Syphilis.....	22	.45
Myocarditis, chronic.....	21	.43
Psychoneurosis, neurasthenia.....	16	.33
Otitis, media, chronic.....	13	.26
Arterial hypertension.....	10	.20
Deafness, bilateral.....	9	.18
Psychoneurosis, psychasthenia.....	9	.18
Diabetes mellitus.....	9	.18
Ulcer, duodenum.....	7	.14
Myopia.....	7	.14
Dementia præcox.....	7	.14
Nephritis, chronic.....	7	.14
Arteriosclerosis, general.....	6	.12
Astigmatism.....	6	.12
Color blindness.....	6	.12
Psychosis, manic depressive.....	5	.10
Asthma.....	5	.10
Bronchitis, chronic.....	4	.08
Angina pectoris.....	4	.08

TABLE XIII.—Cause of retirement from active service by reason of physical disability, officers of the Navy and Marine Corps—Continued

	Number	Rate per 1,000
Sinusitis, maxillary.....	4	0.08
Anemia, pernicious.....	3	.06
Calculus.....	3	.06
Epilepsy.....	3	.06
Hypermetropia.....	3	.06
Tabes dorsalis.....	3	.06
Psychosis, unclassified.....	3	.06
Aneurysm, aorta.....	2	.04
Colitis, chronic.....	2	.04
Encephalitis, lethargic, acute.....	2	.04
Gastritis, chronic.....	2	.04
Hernia, inguinal.....	2	.04
Hyperthyroidism.....	2	.04
Influenza.....	2	.04
Insufficiency, ocular muscle.....	2	.04
Neuritis, multiple.....	2	.04
Paralysis agitans.....	2	.04
Rheumatic fever.....	2	.04
Tonsillitis, acute.....	2	.04
Tuberculosis, unclassified.....	2	.04
Ulcer, stomach.....	2	.04
Varicose veins.....	2	.04
Abscess, shoulder.....	1	.02
Albuminuria.....	1	.02
Arthritis:		
Chronic—		
Knee.....	1	.02
Spine.....	1	.02
Deformans, polyarticular.....	1	.02
Cholecystitis, chronic.....	1	.02
Chorea.....	1	.02
Choroiditis.....	1	.02
Cirrhosis:		
Liver—		
Atrophic.....	1	.02
Fatty.....	1	.02
Constitutional psychopathic inferiority, without psychosis.....	1	.02
Constitutional psychopathic states:		
Emotional instability.....	1	.02
Inadequate personality.....	1	.02
Paranoid personality.....	1	.02
Deafness, unilateral.....	1	.02
Detachment, retina.....	1	.02
Duodenitis.....	1	.02
Dysentery, entamebic.....	1	.02
Emphysema, pulmonary.....	1	.02
Erysipelas, legs.....	1	.02
Gallstones.....	1	.02
Gastroduodenitis.....	1	.02
Glioma, cerebellum.....	1	.02
Goiter.....	1	.02
Hemianopsia.....	1	.02
Hemorrhage into retina.....	1	.02
Melancholia, involutional.....	1	.02
Opacity, vitreous humor.....	1	.02
Otosclerosis.....	1	.02
Paranoid state.....	1	.02
Paralysis, ocular muscle.....	1	.02
Poliomyelitis, anterior, chronic.....	1	.02
Retinitis.....	1	.02
Rhinitis, atrophic.....	1	.02
Sclerosis, disseminated.....	1	.02
Septicemia.....	1	.02
Splanchnoptosis.....	1	.02
Strabismus.....	1	.02
Thrombo-angiitis, obliterans.....	1	.02
Tonsillitis, chronic.....	1	.02
Tuberculosis:		
Epididymis.....	1	.02
Of genito-urinary.....	1	.02
Of joint, wrist.....	1	.02
Pleura.....	1	.02
Pulmonary, chronic, arrested.....	1	.02
Tumor, benign, mixed, intracranial.....	1	.02
Valvular heart disease:		
Aortic stenosis.....	1	.02
Mitral insufficiency.....	1	.02
Mitral stenosis.....	1	.02
Varicose veins, trunk.....	1	.02
Injuries.....	21	.43

Appearances possibly to the contrary, I have not sought to build up a case for the Navy. Nor does this paper undertake to combine with its statistical data parallel figures from other communities. Only general comparisons have been made as a basis for my observations and in the confident assumption that data are already available to you for the required detailed comparisons. What I have attempted without too great detail is a picture of the conditions and circumstances prevailing in the Navy as they affect the insuring class of its personnel.

The reasonably creditable mortality and morbidity records of the Navy's officer personnel are not only evidence of the value of life extension examinations, if we may adopt the phrase, and of health supervision partaking of old line "family physician" relationship, modified, of course, by present-day knowledge, but, to paraphrase Stitt, these records indicate that type of individual and that degree of intelligence which leads to self-care and an interest that slight ailments or disabilities shall not be allowed opportunity to become serious ones. We are, of course, not satisfied and are striving by every means to reduce the rates. As Doctor Dingman (10), of the Continental Assurance Co., has said, "Lamentable truth, we die too soon; we die too often." In proof of the sincerity of my assertion that I have not sought to build up a case for the Navy, I freely admit that theoretically we die before our time and suffer needlessly in the Navy as in other communities. The future must bring an extension of interest in any measure which promises to promote health conservation and a fuller use of the resources placed at our disposal by the advances made in medical science.

REFERENCES

1. Pearl, Raymond: Introduction to Medical Biometry and Statistics. Ed. 2, 1930, p. 238.
2. Muhlberg, W.: Proceedings of the Twentieth Annual Meeting, Medical Section, American Life Convention, 1930, p. 21.
3. Stitt, E. R.: Health Examinations Based on Twenty Years' Naval Experience. Proc. Los Angeles County Med. Assoc., 1930.
4. Editorial, The Fat and the Lean. Illinois Health Messenger, 2: September, 1930.
5. Riesman, D.: High Blood Pressure and Longevity. J. A. M. A. 96:1105. April 4, 1931.
6. Editorial, Detecting the Big Killers. Illinois Health Messenger, 3: March, 1931.
7. Snow, E.: Buy—Don't be Sold—Insurance. U. S. Naval Institute Proc. 57:181, February, 1931.
8. De Foney, C. G.: A Psychological Study Made on Candidates for Aviation Training. U. S. N. Med. Bull. 29: 191, April, 1931.
9. Dublin, L. I.: What Price Doctors. Harper's Magazine, 1930.
10. Dingman, H. W.: Life and Death in 1930. Weekly Bulletin, Calif. State Dept. of Public Health, 10: February, 1931.

TOXIC EFFECTS OF ARSENICAL COMPOUNDS EMPLOYED IN THE TREATMENT OF SYPHILIS IN THE UNITED STATES NAVY

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Since November, 1924, medical officers of the Navy have been required to make monthly reports of the numbers of doses of arsphenamine and neoarsphenamine, etc., administered. A separate account of every case in which ill effects are noted is also required.

Previous articles dealing with the information obtained from these reports were published in the September, 1925, January, 1927, January, 1929, and July, 1930, numbers of the *BULLETIN* and covered the subject up to and including the calendar year 1928. The present article supplements these and is in the interest of continuous published statistical information relative to the ill effects experienced from the administration of arsenicals in the United States Navy. This installment takes into consideration the doses of arsenical compounds administered in the treatment of syphilis during the calendar year 1929 and includes comparative figures for the 5-year period 1925-1929.

We have endeavored to continue the classification of reactions in the manner adopted by Commander J. R. Phelps, Medical Corps, United States Navy, in his fourth contribution which appears in The Division of Preventive Medicine section of the *BULLETIN* of July, 1930. The groups for 1929 are as follows:

Encephalitis hemorrhagica.....	0
Vasomotor phenomena (shocklike, "nitritoid," anaphylactoid, etc.).....	32
Exfoliative dermatitis and its complications.....	19
Acute yellow atrophy of the liver.....	0
Acute toxic cirrhosis of liver.....	1
Jaundice	1
Acute renal damage.....	0
Ulcerative enteritis.....	0
Polyneuritis.....	1
Aplastic anemia.....	2
Herxheimer reactions.....	0
Reactions of minor importance, including those in which there were insufficient data for classification.....	10
Total.....	66

The following table ¹ shows by years the number of various arsenical compounds administered by naval medical officers in the treatment of syphilis from January 1, 1925, to December 31, 1929, with ratio of combined instances of fatal and nonfatal toxic effects and of deaths to the number of doses administered:

¹ This is in substitution for Tables 1 and 2 in the article on this subject published in the United States Naval Medical Bulletin, Vol. XXVII, No. 3, July, 1930.

TABLE No. 1

Year, preparation and number of doses administered		Mild reactions	Severe reactions	Fatal reactions	Total reactions	Ratio of reactions to doses—1 reaction to—	Ratio of deaths to doses—1 death to—
1925:							
Arsphenamine.....	5,282	8	3	0	11	480	0
Neocarsphenamine.....	41,791	52	17	2	71	589	20,896
Sulpharsphenamine.....	644	0	0	0	0	0	0
Tryparsamide.....	1,160	0	0	0	0	0	0
Total.....	48,877	60	20	2	82	596	24,439
1926:							
Arsphenamine.....	6,501	6	6	0	12	542	0
Neocarsphenamine.....	55,651	24	2	4	30	1,855	13,913
Sulpharsphenamine.....	1,011	0	0	0	0	0	0
Tryparsamide.....	1,232	0	0	0	0	0	0
Total.....	64,395	30	8	4	42	1,533	16,099
1927:							
Arsphenamine.....	5,749	1	1	1	3	1,916	5,749
Neocarsphenamine.....	68,340	28	9	4	41	1,667	17,085
Sulpharsphenamine.....	389	0	0	0	0	0	0
Tryparsamide.....	2,054	1	0	0	1	2,054	0
Total.....	76,532	30	10	5	45	1,701	18,808
1928:							
Arsphenamine.....	5,093	10	2	0	12	424	0
Neocarsphenamine.....	71,754	35	11	6	52	1,380	11,969
Sulpharsphenamine.....	3,153	3	0	0	3	1,051	0
Tryparsamide.....	2,551	0	0	0	0	0	0
Total.....	82,551	48	13	6	67	1,232	13,759
1929:							
Arsphenamine.....	5,018	0	1	0	1	5,018	0
Neocarsphenamine.....	76,688	35	25	3	63	1,217	25,563
Sulpharsphenamine.....	1,345	0	2	0	2	673	0
Tryparsamide.....	2,383	0	0	0	0	0	0
Miscellaneous.....	58	0	0	0	0	0	0
Total.....	85,492	35	28	3	66	1,295	26,497
Totals for 5 years:							
Arsphenamine.....	27,643	25	13	1	39	709	27,642
Neocarsphenamine.....	314,224	174	64	19	257	1,223	16,538
Sulpharsphenamine.....	6,542	3	2	0	5	1,308	0
Tryparsamide.....	9,380	1	0	0	1	9,380	0
Miscellaneous.....	58	0	0	0	0	0	0
Grand total.....	357,847	203	79	20	302	1,185	17,892

While the admission rate for syphilis for 1929 was 0.35 per cent less than the weighted average for the preceding 5-year period and 4.63 per cent less than the admission rate for 1928, the above table shows that more treatments were administered in 1929 than any of the four preceding years and that the number of treatments has increased yearly since 1925. The upward trend in the numbers of doses of arsenicals administered from year to year does not indicate that there are more new cases of syphilis to treat among the Navy and Marine Corps personnel. This is evident from the fact that there were 200 fewer admissions for syphilis in 1928 than in 1927 and 93 fewer admissions in 1929 than in 1928. The increase in the

number of treatments administered can probably be accounted for by the fact that, in addition to the men who are originally admitted with syphilis during the year, treatment is also accorded men in an unknown number who have been infected in previous years and in which absence from regular duties is not required, patients who acquired a syphilitic infection in previous years and who are readmitted to the sick list for treatment, supernumerary patients (Veterans' Bureau cases and retired personnel, etc.), dependents of naval and Marine Corps personnel, and civil populations of insular possessions. Information concerning all such cases is included in the monthly and special reports from medical officers throughout the United States naval service, and by means of them the bureau of medicine and surgery is able to keep a complete record of the statistics of syphilis and numbers of doses of the different arsenical compounds administered, with studies of the ill effects encountered. It is believed that this routine, together with the periodic publication of accumulated data, has had a stimulating effect resulting in a more diligent and systematic effort to detect cases, increasing attention to institution of the treatment in new cases as discovered, and a closer follow up and more thorough treatment of old cases. This, of course, has been facilitated by the extension of laboratory facilities and the widespread use of Kahn precipitation test in the field.

Referring to the above 5-year table, the ratios of reactions and deaths to the number of doses for 1929 are: Reactions, 1 to 1,295, and deaths, 1 to 28,497. This compares favorably with the 5-year averages, which show 1 reaction to 1,185 doses administered and 1 death to 17,892 doses.

Deaths charged to the administration of arsenical compounds in the treatment of syphilis during the past 11 years were recorded as follows:

Year	Ars-phen-amine	Neoars-phen-amine	Kind not specified	Total	Year	Ars-phen-amine	Neoars-phen-amine	Kind not specified	Total
1919.....	2	0	1	3	1926.....	0	4	0	4
1920.....	1	1	0	2	1927.....	1	4	0	5
1921.....	3	1	0	4	1928.....	0	6	0	6
1922.....	0	4	0	4	1929.....	0	3	0	3
1923.....	0	1	0	1					
1924.....	1	2	0	3	Total.....	8	28	1	37
1925.....	0	2	0	2					

Supplementing Table 4 of the July, 1930, article, the three deaths which occurred in 1929 are as follows:

Immediate cause of death	Arsphen-amine	Neoarsphenamine
Previously listed.....	8	25
Toxic cirrhosis of the liver:		
1929—		
Death 44 days after fourth injection of third course.....	0	1
Aplastic anemia:		
1929—		
Death about 8 days after twenty-sixth dose included in 3 courses.....	0	1
Death 21 days after last dose, had antiluetic treatment since 1912.....	0	1
Total.....	8	28

HEMORRHAGIC ENCEPHALITIS

A detailed account of the 21 cases of hemorrhagic encephalitis occurring in the Navy from 1918 to 1928 is given in the previous article. The account includes 20 deaths from this cause and one case that terminated in recovery. No cases of hemorrhagic encephalitis occurred during the year 1929.

Cases suggesting border-line relationship between acute hemorrhagic encephalitis and the other forms of acute poisoning by arsenical compounds used in the treatment of syphilis.—(NOTE.—These cases are included in the figures for vasomotor phenomena.)

During the year 1929 three reactions occurred which seem to fall under this heading.

Neoarsphenamine.—A patient, who was exposed June 15, 1927, developed a "chancroid ulcer." On August 15, 1927, he gave a 4 plus Kahn test and was given one injection of 0.45 gram of neoarsphenamine, followed by eight injections of 0.6 gram each over the period to September 30, 1927. On September 6, 1927, the Kahn test was 4 plus and on September 26 negative. October 30, 1928, or 13 months after the first course had been completed, he was given an intravenous injection of 0.45 gram of neoarsphenamine. About one hour after this injection the patient noted a fever and had severe headache. Several hours later he reported with headache, chills, vertigo, anorexia, flushed face, and a temperature of 103° F. The fever persisted for two days, rising to 104.6° and then subsiding, but headache persisted. There was some evidence of mental disturbance with wandering speech two days after the injection. Recovery was complete November 8, 1928, or nine days after the injection.

A case infected in August, 1928, was diagnosed by serological examination November 27, 1928. December 10, 1928, he was given 1 grain of mercury salicylate, December 12, 0.45 gram of neoarsphenamine and December 20, 0.9 gram of neoarsphenamine.

Four hours after this last injection his temperature rose to 106° F. There was edema of hands and face. The patient complained of pain over entire cranium, particularly the occipital region and was apprehensive and nervous, with subsequent dulling of mental faculties. Urine was negative for albumin. His immediate treatment consisted of an enema, a saline purge, and hydrotherapeutic measures. Sodium thiosulphate (grains 15) was given intravenously 24 hours after injection. Twelve hours after the administration of the sodium thiosulphate, or 36 hours after the neoarsphenamine injection, the patient was free of all symptoms, temperature normal, and urine negative for albumin.²

Arsphenamine.—A patient was admitted January 10, 1929, with a large indurated ulcer. Dark field examination was positive for T. P. and two Kahn tests were four plus. On January 16, 1929, he was given a 0.25 gram injection of arsphenamine and on January 23, an injection of 0.3 gram. Thirty hours after this second injection the patient vomited, had a severe chill, and was hazy in answering questions. The morning of the second day following vomiting had ceased but the patient was dull, apathetic, and mentally hazy. Sodium thiosulphate in 1-gram doses was given every six hours, and free elimination induced. On January 27, 1929, petechia appeared all over the body, more marked on the neck and shoulders, and in the conjunctivae, but the next day the patient was mentally clearer and otherwise improving and medication was discontinued. By February 10 the hemorrhages had disappeared and a month later he was regarded as entirely recovered.

Proportion of deaths from hemorrhagic encephalitis to numbers of patients treated for syphilis and to numbers of doses of arsenical compounds administered.—As mentioned above, no deaths occurred from this cause during the year 1929. During the 5-year period 1925–1929 the average number of patients (Navy and Marine Corps personnel) treated for syphilis in the Navy per annum was 3,215. During that period the average number of deaths per annum from arsenical hemorrhagic encephalitis was 2.5. The compounds responsible for these deaths were *arsphenamine* and *neoarsphenamine*. For both together the ratio was 1 death for every 1,286 patients treated.

With respect to numbers of doses of the drugs administered during this period, there were 27,643 intravenous injections of arsphenamine with 1 death. There were 314,224 intravenous injections of neoars-

² The report shows that five other patients received the same dosage of the same lot on the same day with no reactions. Subsequently the same lot was used in the treatment of this man and others with no reaction. The medical officer reporting this case states, "In spite of examination of the ampule and the apparent normal color and great solubility of the drug in question, it is the opinion of the medical officer that the ampule must have had a minute break with beginning deterioration of its contents."

phenamine during the same period, resulting in 10 deaths from hemorrhagic encephalitis, giving a ratio of 1 death to 31,422 doses administered.

During this period of 5 years 6,542 doses of sulpharsphenamine and 9,380 doses of tryparasamide were administered, with no deaths from any cause referable to the arsenical compound.

VASOMOTOR PHENOMENA

Altogether during the 5-year period 1925-1929, 110 cases were reported by medical officers of the Navy, 78 of which were grouped in the July, 1930, article as examples of vasomotor phenomena following the intravenous injection of neoarsphenamine or other arsenical compounds. Thirty-two cases were reported in 1929, three of which are listed above under border line hemorrhagic encephalitis. The remaining 29 reactions seem to fall under the heading of "vasomotor phenomena," using the term with its connotations as discussed in the previous article.

Deaths.—There were no fatal cases of arsphenamine or neoarsphenamine poisoning during the year 1929 to be classed under vasomotor phenomena. The 2 deaths which have occurred during the 5-year period 1925-1929 give a ratio of 1 death to 8,038 patients treated. This is obtained by dividing the yearly average number of syphilitic patients treated by the yearly average number of deaths from this cause during the period. We do not know the actual number of different individuals treated for syphilis. Every year a number of men are treated who began treatment several years before and these are not necessarily readmitted to the sick list, but the figures used make allowance for carry-over cases and are approximately correct. We do know the total numbers of doses of the several arsenical compounds administered during the 5-year period. For neoarsphenamine there was 1 death (vasomotor phenomena) to 157,112 intravenous doses, and for arsphenamine no deaths from 27,643 doses.

Nonfatal cases of arsphenamine and neoarsphenamine poisoning classed as vasomotor phenomena

Hours after injection	Injection	Dose in grams	Time of recovery	Further treatment without reaction
<i>14 during first course</i>				
3.....	First....	0.45 neoarsphenamine..	24 hours...	Completed course.
6.....	do....	0.3 neoarsphenamine..	do.....	No record.
4.....	do....	0.45 neoarsphenamine..	36 hours...	1 injection with atropine and sodium thiosulphate, followed 1 week later with 1 injection neoarsphenamine only.
4.....	Second..	0.9 neoarsphenamine..	do.....	Yes (amount not stated).
30.....	do....	0.3 arsphenamine.....	34 days...	Bismuth.
3.....	do....	0.6 neoarsphenamine..	3 days...	No record.
3.....	do....	do.....	do.....	Do.
8.....	do....	do.....	5 days...	Do.
5.....	Third...	do.....	3 days...	Do.

Nonfatal cases of arsphenamine and neoarsphenamine poisoning classed as vasomotor phenomena—Continued

Hours after injection	Injection	Dose in grams	Time of recovery	Further treatment without reaction
<i>14 during first course—Continued</i>				
6.....	Third.....	0.6 neoarsphenamine..	3 days.....	0.3 gram neoarsphenamine 1 week later.
"Several".....	do.....	0.75 neoarsphenamine..	2 days.....	No record.
2.....	do.....	0.6 neoarsphenamine..	3 days.....	Do.
1.....	do.....	do.....	15 days.....	Do.
4.....	Fourth.....	do.....	30 hours.....	Reaction followed third, fourth, fifth, and sixth injections, completed 8 injections.
● <i>7 during second course</i>				
1.....	First.....	0.45 neoarsphenamine..	9 days.....	No record.
4.....	do.....	do.....	24 hours.....	No record (3 previous reactions).
Immediately.....	Second.....	0.6 neoarsphenamine..	do.....	No record.
Do.....	do.....	do.....	2 days.....	Bismosol (2 reactions on previous course).
4.....	Fourth.....	0.9 neoarsphenamine..	9 hours.....	Yes (next case). ¹
5.....	Sixth.....	0.45 neoarsphenamine..	24 hours.....	No record.
Time not stated.....	Eighth.....	(?) neoarsphenamine..	16 days.....	Do.
<i>5 during third course</i>				
During injection.....	Second.....	0.15 neoarsphenamine..	5 hours.....	23 days after—0.45 neoarsphenamine.
1.....	do.....	0.9 neoarsphenamine..	4 days.....	No record.
During injection.....	Fourth.....	0.36 neoarsphenamine..	2 days.....	Do.
Immediately.....	Fifth.....	0.9 neoarsphenamine..	24 hours.....	Do.
3/4.....	Sixth.....	do.....	do.....	Do.
<i>4 during fourth course</i>				
During injection.....	Third.....	0.225 neoarsphenamine..	do.....	Do.
Do.....	do.....	0.4 neoarsphenamine..	do.....	Discontinued.
Time not stated.....	do.....	0.6 neoarsphenamine..	do.....	No record.
24.....	Fourth.....	do.....	32 days.....	Bismuth.
<i>1 during fifth course</i>				
Immediately.....	Third.....	do.....	9 hours.....	No record.

¹ Same man.

NOTE.—One reaction followed the twentieth injection (course not stated, probably third), time not stated; dose not stated; recovered in 13 days; no record of further treatment.

As will be seen from the above tabulation, 31 reactions of this class followed the intravenous injection of neoarsphenamine and one followed an intravenous injection of arsphenamine.

Temperature.—In the above 32 reactions the elevation of temperature was reported as a prominent symptom in 22 instances, the temperature was not mentioned in 9 instances and in 1 instance the temperature was subnormal.

First symptoms.—From the case reports the following appear to be the first symptoms noted:

Symptoms:	Cases
Fever and headache.....	6
Fever and chills.....	4
Fever, headache, and chills.....	2
Headache and nausea.....	2
Faintness and nausea.....	2
Vomiting.....	2
Fever.....	1

Symptoms—Continued.

	Cases
Fever, headache, and general prostration.....	1
Chills and vomiting.....	1
Chills, flushed skin, and conjunctival injection.....	1
Vertigo, nausea, and vomiting.....	1
Unconsciousness, cyanosis, rapid thready pulse, and vomiting.....	1
Choking sensation and syncope.....	1
Oppression in chest and dyspnea.....	1
Cyanosis, cold clammy skin, weak rapid pulse, and dyspnea.....	1
Cyanosis, failing pulse.....	1
Flushed face, conjunctival injection, cough, and vomiting.....	1
Urticarial eruption, tingling lower limbs, swelling about eyes.....	1
Redness and swelling both wrists.....	1
Pain lumbosacral region.....	1

Symptoms.—There was one instance in which there was fever only; in all the others there were two or more symptoms. The various manifestations encountered follow in order of frequency: Fever, 22; chills, 14; headache, 13; vomiting, 10; nausea, 8; flushing, 7; local pains, 7; edema, 6; weak and rapid pulse, 6; mental disturbance, 6; conjunctival injection, 5; cyanosis, 5; albumin in urine, 4; general aching, 4; dyspnea, 4; stupor, 3; scarlatiniform rash, 3; unconsciousness, 2; faintness, 2; general prostration, 2; vertigo, 2; nervousness, 2; urticarial eruption, 2; petechial hemorrhages, 1; cough, 1; bloody vomitus, 1; bloody stool, 1; granular casts in urine, 1; diarrhea, 1; generalized joint pains, 1; burning sensation (epigastrium), 1; cold, clammy skin, 1; profuse sweating, 1; cold extremities, 1; general malaise, 1; laryngeal stenotic signs, 1; rigors, 1; tingling (lower extremities), 1; dilation of pupils, 1; thoracic oppression, 1.

Cases.—A patient infected in 1923 received six injections of salvarsan from October 19 to November 30, 1923; six injections of salvarsan from July 15 to August 19, 1924; and eight injections of neosalvarsan of 0.9 gram each from December 14, 1927, to February 17, 1929. On August 16 and 27, 1929, he received the first two injections of his fourth course, and the report shows also that he received one injection of mercury at this time. On September 4, 1929, the patient was to receive the third dose of his fourth course for which a solution of 0.9 gram of neoarsphenamine in 20 c. c. of sterile distilled water was prepared. Five c. c. of this solution (0.225 gram neoarsphenamine) had been injected in one minute when the patient's face became flushed and conjunctivae injected, and he coughed and then vomited. The injection was immediately stopped. The time of this occurrence is not given, but the report states that at 11 a. m. the patient had a slight chill, with a temperature of 100.5° F. and pulse of 105, and he complained of headache. At 12 noon his temperature was 102° F. and his pulse 116. He was then trans-

ferred to a naval hospital, where he rapidly improved without any special treatment and was entirely free from symptoms the following day.

A patient infected in June, 1924, received injections of arsenicals, presumably neoarsphenamine, as follows: From June 18 to November 2, 1924, two courses, totaling 10.8 grams; from August 9 to September 7, 1928, one course, totaling 5.6 grams; from October 23 to December 18, 1928, one course, totaling 4.15 grams. No concurrent treatment of other nature is reported. His fifth course was begun on October 22, 1929, with 0.3 gram neoarsphenamine, followed by 0.45 gram on October 25 and 0.6 gram on October 29, 1929. This last injection was given in one minute and was immediately followed by a reaction. The symptoms were slight dizziness, followed by nausea and vomiting, vomitus containing a considerable amount of blood. Patient was cyanotic and complained of pain in chest and back and severe chill. His temperature was 99° F., pulse 132, and respiration 20. The urine was positive for albumin one hour after injection. One gram of sodium thiosulphate was given intravenously about 15 minutes after the first symptoms of reaction and patient recovered in about 9 hours.*

A patient infected in July, 1927, received treatment as follows: From August 16 to October 4, 1927, eight intravenous injections of neoarsphenamine and mercury bichloride and potassium iodide orally for eight weeks; from February 14 to March 27, 1928, seven intravenous injections of neoarsphenamine and mercury bichloride and potassium iodide orally for seven weeks; from January 14 to March 14, 1929, eight intravenous injections of neoarsphenamine and mercury bichloride and potassium iodide orally for eight weeks. His fourth course began on July 29, 1929, with a 0.4-gram injection of neoarsphenamine, and on August 6, 1929, he received a 0.6-gram dose. On August 13, 1929, he received 0.4 gram of the third injection of his fourth course. During this injection the patient lost consciousness, became cyanotic, with rapid, thready pulse, and vomited small quantities of bile. His pupils were widely dilated and muscles flaccid. There was no convulsion. Patient was given 0.5 c. c. adrenalin hypodermically and 1 gram of sodium thiosulphate intravenously. He regained consciousness in about 20 minutes, but continued stuporous and felt nauseated for about five hours. Temperature rose to 102.4° F. Pulse returned to normal. After 24 hours he felt perfectly well, with no unfavorable signs except 1 plus albumin, coarsely granular casts, and red and white blood cells in urine. Another 1 gram of sodium thiosulphate was given by vein at this time. On

* The reporting medical officer notes that this patient was 1 of 16 other men who received the same drug with no reactions.

August 15, 1929, the patient was sent to duty and arsenical treatment discontinued.⁴

A patient infected in September, 1927, had received two courses between September 26, 1927, and June 2, 1928, consisting of 16 injections of neoarsphenamine, mercury rubs, and potassium iodide (grains 10) and protoiodide of mercury (grain 1/6) t. i. d. His third course was begun January 8, 1929, with one injection of neoarsphenamine (dose not stated), but due to transfer to another station the treatment was interrupted, and it was not until October 1, 1929, that treatment was resumed. On this date the patient had received 5 c. c. in 10 seconds of a solution of 0.6 to 20, or 0.15 gram of neoarsphenamine, when the injection was stopped on account of a reaction which is reported as beginning immediately after injection was started. The symptoms reported were marked cyanosis and failing pulse, followed by chill and bloody stool. The patient was given atropine sulphate $\frac{1}{160}$ grain and adrenalin 15 minims, followed by sodium thiosulphate intravenously one hour later. Following the sodium thiosulphate the patient was transferred to a naval hospital, from which it was reported that he was apparently normal five hours after the beginning of the reaction. He returned to duty October 4, 1929. This patient gave a history of a previous similar but more severe reaction. Treatment was continued in this case without ill effect, i. e., he received $\frac{1}{5}$ grain of mercury October 19, 1929, and 0.45 gram neoarsphenamine October 24, 1929, without reaction.

A patient infected in February, 1928, received a short course of three injections of neoarsphenamine from March 7 to 23, 1928, and a second course of seven injections of neoarsphenamine from May 5 to August 10, 1928. During his third course in 1929 he received intramuscular injections of mercury bichloride 0.01 gram on January 8, 22, 25, 29, and February 12 and 19, with potassium iodide as concurrent treatment, and neoarsphenamine as follows: January 22, 0.9 gram; January 29, 0.9 gram; February 12, 0.9 gram; February 19, 0.9 gram; and February 26, 0.9 gram. Immediate reaction followed the injection of February 26, with symptoms as follows: Cyanosis, cold clammy skin, weak rapid pulse, dyspnea, and later some edema of the face and lumbar pains. The urine was negative for albumin and casts but positive by Dicken's test for arsenic. One gram of sodium thiosulphate was given intravenously immediately and symptoms began to subside. Treatment was con-

⁴ The reporting medical officer states that there was no history of physical or dietary indiscretion prior to administration of drug and past history of the patient was negative for drug reaction; that the quality of drug and technique of injection was beyond suspicion; and that he regarded the above manifestations as a moderately severe "nitritoid" reaction in a patient whose tolerance for arsenic had been exceeded.

tinued and recovery was complete within 24 hours, but the patient was kept on the sick list for 2 days.⁵

A patient infected in July, 1928, received 6 injections of arsphenamine and 6 gluteal injections of mercury succinimide from July 25 to August 30, 1928, and 5 injections of neoarsphenamine and 5 intragluteal injections of mercury succinimide from November 6 to December 6, 1928. For his third course in 1929 he received, on August 29, 0.45 gram of neoarsphenamine; August 27, 0.9 gram; and September 3, 0.9 gram, with concurrent treatment of 0.026 gram of mercury succinimide on August 22, August 29, and September 5. On September 10 the fourth dose of his third course was given. The patient had received about 8 or 9 c. c. of a 0.9 to 20 solution of neoarsphenamine, or about 0.36 to 0.405 gram, when symptoms of a reaction were noticed and the injection stopped. At this point the patient suddenly complained of a feeling of oppression in his chest and difficulty in breathing. He became nauseated and vomited quite violently for a few minutes. He was given 1 c. c. of epinephrine subcutaneously within 10 minutes of the onset which relieved the dyspnea and chest oppression, but the patient continued to retch violently and vomit small amounts. His temperature was 97.6 pulse 104, and respiration 20 one hour after onset. The urine showed a trace of albumin two hours after onset, but was otherwise negative. He had a severe headache and very irritable stomach for about 18 hours and it was impossible for him to retain water during this period. The patient was feeling very weak but much improved after 24 hours. Gastric symptoms did not yield well to lavage of sodium bicarbonate solution, but was helped by morphia 0.016 gram subcutaneously. Sodium thiosulphate was not used. The patient recovered and was able to return to duty September 12, 1929.

A patient who had completed one course three months previously was given 0.4 gram of neoarsphenamine as the first dose of his second course and 0.6 gram as the second dose. Immediately following this second dose of the second course he became faint, nauseated, and weak. His face became pale, his lips blue, and his pulse weak. One c. c. of adrenalin solution was given as treatment for the reaction. The dates of injections and time of recovery from the reaction were not given. The case is reported as one of slight reaction.

A patient infected in May, 1928, received one course of arsenical treatment from June 22 to August 23, 1928, and another course from January 3 to February 14, 1929. In his third course, which began July 25, 1929, he received 0.05 gram of mercury salicylate on August

⁵ The reporting medical officer notes that 17 doses of the same lot number of neoarsphenamine were administered the same day with no other case of reaction.

6, 13, 20, and 27, and intravenous injections of neoarsphenamine as follows: July 25, 0.45 gram; August 1, 8, 15, 22, and 29, 0.9 gram each. Forty-five minutes after the sixth dose of his third course the patient developed a choking sensation and fainted, regaining consciousness in four or five minutes. His pulse rate was 88 and his temperature normal. Forty minutes later his temperature rose to 100.2 and his pulse rate to 99. There is no record of any other symptoms. Sodium thiosulphate 1 gram was given 45 minutes after onset of reaction and the patient fully recovered on the following day.

A case in which the time and place of infection are reported as unknown was admitted with syphilis because of 4 plus Kahn tests on December 26, 1928, and January 10, 1929, and generalized glandular enlargement. His first course was begun and he was given mercury inunctions every other day from January 14 to January 24, and 0.3 gram neoarsphenamine on January 14, and 0.6 gram on January 24, 1929. Three hours after receiving his second dose of neoarsphenamine a reaction occurred. There was headache, general prostration, and fever of 104.2° F. The patient was restless most of the afternoon and night and got very little sleep. The next day, as his condition had not changed, he was transferred to a naval hospital. There improvement was rapid, and by January 27, 1929, his temperature was normal and he had no complaints. The treatment in this case consisted of magnesium sulphate by mouth, sodium thiosulphate by vein, abundance of water, alcohol rubs, and ice cap. Recovery was complete on the fourth day after injection.

A patient admitted with syphilis March 16, 1929, received his first course from March 16 to May 4, 1929, consisting of eight injections of neoarsphenamine, totaling 5.20 grams. On June 29, or eight weeks later, an injection of neoarsphenamine 0.45 gram was given as the first dose of his second course. Four hours after this dose the patient had chills, fever (102° F.), severe headache, and general aching, especially in the hips and small of the back. His face and head were flushed. The urine was negative both before and after the injection. The patient stated that he had had similar reactions after the last three injections of the first course. He was put to bed, placed on light diet rich in carbohydrates, and given sodium thiosulphate 1 gram intravenously. The following day the temperature was normal and the patient was returned to duty apparently fully recovered.

A patient being treated for syphilis for the first time received 0.45 gram of neoarsphenamine as the first dose of his first course. Three or four hours after this injection the patient had chills, a temperature of 105° F., rapid pulse and generalized pain in muscles. Sodium thiosulphate 1 gram was given intravenously and in about

two hours the temperature dropped to 102° F. The patient was fully recovered the following morning.⁶

A patient who had given repeated positive Kahn blood reactions was started on his first course of treatment and received 0.4 gram of neoarsphenamine on January 3, 0.6 gram on January 9, and 0.6 gram on January 16, 1929. No other treatment was recorded. Five hours after this third dose the patient had chills, a temperature of 104° F., and general aching sensations. There was no swelling. One gram of sodium thiosulphate was given intravenously. On January 17, 1929, his temperature reached 105° F. with no new symptoms. On January 18, 1929, the patient felt well and had no residual trouble, having entirely recovered in three days.

A patient was admitted to the sick list with an initial lesion of several weeks' duration. He gave a 4 plus Kahn blood test and his first course of treatment was begun. On November 14 he received 0.4 gram of neoarsphenamine; on November 20 and 26, 1929, he received 0.6 gram each. Six hours after this third injection the patient complained of headache. His temperature rose to 105.2 within a few hours and remained between 103 and 105 for 48 hours. No other symptoms appeared. Sodium thiosulphate 1 gram was given intravenously the first and second days and the patient had recovered on the third day. This patient was given an injection of 0.3 gram on December 3, 1929, but no further reaction was reported.

A patient infected in August, 1926, had completed two courses of neoarsphenamine of eight injections each up to August 8, 1928. On December 27, 1928, he was given the first injection of his third course consisting of 0.45 gram of neoarsphenamine, and on January 4, 1929, he received his second dose of this course consisting of 0.9 gram of the same drug. One hour after this second dose the patient complained of headache and chills. His temperature was 102.6° F. No other symptom is reported. He was transferred to a naval hospital and recovered in four days apparently without any special treatment.⁷

A man in the primary stage of syphilis was given 0.45 gram of neoarsphenamine on May 25, 0.6 gram on May 29, and 0.75 gram on June 5, 1929. No other treatment is reported. Several hours after administration the patient's temperature ranged from 104° to

⁶The reporting medical officer notes that on the same day 20 to 30 injections of the same preparation were given without any untoward effects or severe reaction in others. This particular case was not given arsenic again for two weeks, when his first course was begun again with 0.2 gram without any unfavorable reaction. The following week 0.3 gram was given. The first course was completed without any further reaction.

⁷Although the patient had denied having eaten breakfast the morning of the injection, the reporting medical officer was of the opinion that breakfast had been eaten by the man before he returned to the ship from overnight liberty.

105° F. The high temperature persisted on June 6, 1929, and 1 gram of sodium thiosulphate was given intravenously in addition to symptomatic treatment. On June 7, 1929, his temperature was normal and no further ill effects were noted. There had been no marked symptoms other than fever.^a

A patient infected in the first week of December, 1928, later developed a secondary rash over his body and gave a 4 plus Kahn blood test. His first course of treatment was begun on January 30, 1929, with an injection of 0.3 gram of neoarsphenamine. Six hours after this first dose he complained of slight headache and of feeling hot. His temperature was 103, pulse 90, and respiration 20. Eight hours after the injection his temperature was 105.4, pulse 100, and respiration 22. Twelve hours after the injection the temperature was 103 and the patient was resting comfortably. The next morning the patient was normal.

A patient who had been exposed October 22, 1928, developed a chancre which gave a positive dark field. A Kahn blood test was 4 plus. This patient received the first course consisting of eight injections of neoarsphenamine from November 28, 1928, to January 2, 1929, and his second course consisting of eight injections of neoarsphenamine from February 2 to May 2, 1929. Following the eighth injection of the second course (time not stated) the patient complained of severe headache, nausea, and pains in precordial region. He was put to bed, given forced fluids, and daily injections of sodium thiosulphate. The exact time the condition lasted is not stated on the report, but the patient was carried on the sick list for 16 days.

A patient who gave a history of chancroidal infection in 1919, and again in 1923, showed 4 plus Kahn tests twice in 1929, and adenopathy. He was started on his first course of neoarsphenamine with 0.35 gram on June 22, and 0.6 gram on June 29, 1929. No other treatment was reported. A reaction occurred three hours after his second dose. The patient had continued his duties on a submarine for two days before he reported to the sick bay. His symptoms were nausea, vomiting, and severe headache. On admission to the sick list his temperature was 101.2, pulse 110, and respiration 20. Treatment consisted of ice cap to head and forced fluids. The symptoms subsided the third day and the patient returned to duty on the fifth day.

A mild reaction occurred in the case of a patient who had completed three previous courses of eight injections each, presumably neoarsphenamine. Five months had elapsed in which no treatment

^a The reporting medical officer notes that a number of patients treated by the same lot of neoarsphenamine at the same time showed no ill effects.

was given, when his fourth course was started with an injection of 0.4 gram of neoarsphenamine for the first dose, and 0.6 gram for the second and third doses. During this time the patient received two mercury rubs. The dates of the injections were not reported. Following the third injection of the fourth course the patient became nauseated, vomited, and felt faint. This case was reported as a slight reaction and the time of recovery was not stated.

A patient infected September 24, 1928, gave a positive Kahn blood reaction December 26, 1928, and had a secondary rash December 29, 1928. His first course of treatment was started January 3, 1929. On this date he received 0.4 gram neoarsphenamine; on January 9, 0.6 gram; and January 16, 0.6 gram. He is reported as having had no other treatment. Two hours after his third injection a reaction occurred in which there were chilly sensations developing to violent chills, with temperature of 104° F., followed by swelling of hands, feet, and face. The eyes were injected and almost shut. The condition continued all night, but the temperature was normal the next day. The swelling persisted two days. There was no desquamation. One gram of sodium thiosulphate was given intravenously at 2 p. m. on the day the reaction occurred. The patient was entirely recovered after three days.

A patient infected August 1, 1929, with a mixed infection, the dark field examinations of which were negative, showed a 4 plus Kahn blood test September 26, 1929, and was given the first injection of his first course on that date. The dose consisted of 0.45 gram of neoarsphenamine, and four hours after receiving it the patient developed a fever of 100° F., followed by chills and aching pains throughout body and a papular urticarial skin eruption. No special treatment was given, and the next morning all symptoms had disappeared except the eruption, which, however, subsided within 36 hours. When the next injection of the course was due the patient was given atropine sulphate 1/100 grain hypodermically a few minutes before the neoarsphenamine which was given in divided doses; 0.1 gram, followed one hour later by 0.35 gram, followed immediately by 0.8 gram of sodium thiosulphate intravenously. The patient was put to bed and closely watched; no reaction followed. A third dose of 0.45 gram on October 9, 1929, with which no sodium thiosulphate was given, produced no reaction.

A patient who had acquired syphilis in 1927 and had completed three previous courses was given the fourth weekly injection of the fourth course on September 13, 1929. The dates and amounts of the previous injections are not stated on the report. However, the dose on September 13, 1929, the fourth dose of the fourth course, was given as 0.6 gram of neoarsphenamine. The day following this in-

jection the patient presented urticarial lesions over extremities and trunk, tingling in lower limbs, and swelling about the eyes. He gave a history of illness following the two previous injections of neoarsphenamine and stated that his hands and wrists would swell, that "itchy lumps" would appear in spots resembling hives, and that there was puffiness under the eyes. Examination on September 16, 1929, revealed the following: Slightly puffy under the eyes, conjunctivae inflamed, tonsils enlarged and congested, and thyroid gland uniformly enlarged. There were no other palpable glands. The case was treated by free elimination, forced fluids, and soft diet. On October 7, 1929, bismuth was begun, and the patient was returned to duty November 15, 1929.

A patient who had no history of infection other than a chancroid in 1908 gave a positive serum reaction September 23, 1929. November 18, 1929, he was started on his first course and was given 0.45 gram of neoarsphenamine and 0.13 gram of bismuth salicylate on that date. On November 29, 1929, he received 0.6 gram of neoarsphenamine and 0.13 gram of bismuth salicylate. This treatment was given in the morning, and early that night there was a redness and swelling around both wrists. On November 30 this condition had spread to the arms and trunk and was accompanied by a severe diarrhoea. The urine showed albumin. The patient was given sodium thiosulphate and transferred to a hospital. Three doses of sodium thiosulphate were given at the hospital, and the patient returned to duty with no symptoms on December 4, 1929.

A patient infected in January, 1929, was started on his first course upon the appearance of secondaries. On February 24 he was given an injection of 0.3 gram of neoarsphenamine; on February 26, 0.6 gram; and on March 5, 1929, 0.6 gram. No other treatment was reported. One hour after the third injection a reaction occurred in which there were pains in the lumbosacral region, accentuated rash, chills, generalized joint pains, burning sensation in epigastrium, and profuse sweating. On March 6, 1929, after several doses of sodium thiosulphate, the patient was transferred to the hospital ship for treatment, and on March 20 had completely recovered from the reaction.

A patient infected in 1928 and who had had 19 previous injections, presumably in courses, received an injection of neoarsphenamine (dose not stated) on March 28, 1929. This was followed by vomiting, rash, and high fever. He was given 1 gram of sodium thiosulphate, after which he vomited. March 30 another gram of sodium thiosulphate was given and he again vomited. March 31 the rash cleared and there was no more vomiting. April 2 the temperature was normal and the patient suffered no further symptoms.

In 1929 two reactions were reported as having occurred in the same man. The patient was infected in April, 1929, and had completed one course of eight injections, which totaled 6.75 grams of neoarsphenamine. This course was given from April 30 to June 18, 1929. The second course began October 22, 1929, with an injection of 0.6 gram of neoarsphenamine. On October 29 he was given 0.9 gram; on November 5, 0.9 gram; and on November 12, 0.9 gram, after which the first severe reaction occurred. Treatment was continued, and on November 26 he received 0.45 gram of neoarsphenamine, and on December 31 another injection of 0.45 gram. Following this, the second severe reaction occurred. The first reaction, occurring four hours after the 0.9-gram dose given on November 12, 1929, included the following manifestations: Frontal headache, continuous dull pain in abdominal and kidney region, temperature 102° F., pulse 112 and rather weak, respiration 22 and labored, mental depression, flushed face, nausea and vomiting, and cold extremities. He was given sodium thiosulphate 15 grains intravenously at 8 p. m., or six hours after the injection, with amelioration of symptoms, and was able to return to duty about nine hours after the injection. The second reaction occurred five hours after the 0.45-gram dose given on December 31, 1929. This reaction differed from the previous reaction in that there was no abdominal distress. There was severe pain in the kidney region, temperature 102.2° F., pulse 108, flushed face, conjunctival injection, and headache. He was given complete rest in bed with quantities of water by mouth. Two hours after going to bed his temperature subsided and the renal symptoms ceased. The following morning he was free of symptoms.

In 1929 four reactions occurred in the same man during his first course, two of which were considered slight and two severe. The time and place of infection were reported as unknown, but the patient gave a history of a single painless chancroid in May, 1928, and of having been bitten on the right forearm and left ear in August, 1929. His Kahn serum reaction was 4 plus on two occasions. He received his first course of treatment from December 9, 1929, to January 2, 1930, which consisted of daily mercury rubs during this period and neoarsphenamine as follows:

December 9, 1929, 0.4 gram neoarsphenamine: No reaction.
December 12, 1929, 0.6 gram neoarsphenamine: No reaction.
December 16, 1929, 0.6 gram neoarsphenamine: Slight reaction.
December 19, 1929, 0.6 gram neoarsphenamine: Severe reaction.
December 23, 1929, 0.6 gram neoarsphenamine: Severe reaction.
December 26, 1929, 0.3 gram neoarsphenamine: Slight reaction.
December 30, 1929, 0.4 gram neoarsphenamine: No reaction.
January 2, 1930, 0.4 gram neoarsphenamine: No reaction.

No detailed reports were received covering the first, third, and fourth reactions. The second reaction occurred four hours after the 0.6-gram dose was given on December 19, 1929, with the following symptoms: Conjunctival injection; a series of chilly feelings, followed by fever averaging about 102 but at one time reaching 104, flushed skin replaced by scarlatiniform rash, best noted on abdomen and extremities; headache and generalized malaise. The febrile reaction lasted 24 hours, when temperature fell by crisis and remained normal. Pulse and respiration increased in proportion to fever. Dickens' test showed normal elimination of arsenic. Treatment given was sodium thiosulphate 1 gram intravenously and 1 gram by mouth one hour after onset of symptoms, but no beneficial effects were noted. The patient was on the sick list from December 19 to 21, 1929.

A man infected in Boston, Mass., February, 1928, received a course of treatment which was begun March 9, 1928, was discontinued twice because of severe reaction, and was completed April 6, 1928. This first course consisted of six 0.9 gram injections of neoarsphenamine. The second course consisted of 18 grains of mercury succinimide (size and date of doses not stated) and a 0.6-gram injection of neoarsphenamine on December 18, 1928, and on January 8, 1929. Immediately following this last injection of neoarsphenamine symptoms of acute arsenical poisoning occurred and further treatment with the drug was discontinued. The symptoms were frequent vomiting, laryngeal stenotic signs, chill, rigors, and prostration with fever. The patient was given sodium thiosulphate and catharsis at once. He recovered in two days and treatment was continued with bismosol. The report states that mercury was well tolerated by this patient.

DERMATITIS AND DERMATITIS EXFOLIATIVA

Deaths.—No fatal cases occurred from arsenical dermatitis during the year 1929.

Nonfatal cases of dermatitis exfoliativa or arsenical dermatitis.—During the year 1929 there were 19 cases with symptoms and signs ranging from mild to severe, 17 of which followed neoarsphenamine injections and 2 followed injections of sulpharsphenamine. Using the figures in the previous article, in which 24 cases with 4 deaths occurring in 1927 and 1928 were used to determine the fatality rate from arsenical dermatitis, we have for the three years 1927, 1928, and 1929, for neoarsphenamine 41 cases with 4 deaths and for sulpharsphenamine 2 cases with no deaths. This reduces the case fatality rate for neoarsphenamine as determined by these figures from 16.67 to 9.76 per cent.

Among the cases occurring in 1929 there was one in which suspicious eruptions developed and disappeared in 10 days. In this case the use of neoarsphenamine was discontinued and no further damage resulted. One of the patients had an acute reaction after a 0.9-gram dose of neoarsphenamine and again 37 days later after his second dose of 0.6 gram. Sixteen days after this second injection the patient developed an extensive dermatitis, which resulted in his having 69 sick days. Including 1 sulpharsphenamine case, 3 cases had had previous attacks of arsenical dermatitis, 1 giving a history of two attacks with a total of 130 sick days, another a history of one attack with 85 sick days, and the third a history of one attack without sick days.

There were 16 cases of pronounced dermatitis exfoliativa resulting from treatment with neoarsphenamine and 2 cases resulting from treatment with sulpharsphenamine. Some of the available data for these cases are presented below in tabular form.

NEOARSPHENAMINE

Previous courses of treatment	Current course of treatment						
	Dose followed by dermatitis	Total grams	Number of days in course	Average milligrams per day	Concurrent treatment	Onset of dermatitis after last dose	Duration of dermatitis (days)
None.....	Followed fifth, aggravated by sixth.	(?)	35	(?)	Mercury.....	(?).....	64
Do.....	Followed eighth, aggravated by ninth.	7.2	28	257	None recorded....	(?).....	102
Do.....	Ninth.....	5.1	64	80	5.4 mercury injection.	7 days..	74
Do.....	Second.....	1.5	37	41	None recorded....	16 days..	69
Do.....	Fifth.....	2.7	32	84	do.....	13 days..	158
Do.....	Sixth.....	(?)	(?)	(?)	do.....	4 days..	135
Do.....	Followed seventh aggravated by eighth.	3.15	25	126	do.....	(?).....	130
Do.....	Fourth.....	1.8	12	150	$\frac{3}{4}$ grain bismuth bitartrate.	4 days..	103
Do.....	do.....	2.475	18	138	$\frac{4}{5}$ grain Hg. bichloride.	1 day....	37
Do.....	Eighth.....	5.7	42	136	9 grains Hg. salicylate	7 days...	75
No record.....	do.....	4.65	50	93	Daily Hg. rubs and K. I.	1 day....	47
First course, Apr. 18 to July 5, 1929.	Seventh.....	4.05	42	96	do.....	18 days..	35
First course, Nov. 22, 1928, to Jan. 12, 1929.	Feb. 7 to 28, 1929, number of doses not stated.	(?)	21	(?)	Creolin and balsam, Peru ointment for scabies.	3 days...	39
First course, Jan. 4 to Mar. 13, 1928, followed by dermatitis with 30 sick days; Aug. 22, 1928, 0.2 gram arsphenamine, followed by dermatitis with 100 sick days.	First.....	.45	1	-----	Mixed treatment..	5 hours..	56
First course, Oct. 19, 1927, to Jan. 4, 1928, 5.4 neoarsphenamine; second course, Mar. 7 to Apr. 26, 1928, 4.8 neoarsphenamine.	Eighth.....	7.2	62	116	Sulphur ointment for scabies; daily Hg. inunctions.	4 days...	92

NEOARSPHENAMINE—Continued

Previous courses of treatment	Current courses of treatment						
	Dose followed by dermatitis	Total grams	Number of days in course	Average milligrams per day	Concurrent treatment	Onset of dermatitis after last dose	Duration of dermatitis (days)
First and second courses, Feb. 2 to July 27, 1928, 15 injections arsphenamine. Third course, Sept. 25 to Nov. 6, 1928, 6.3 neoarsphenamine, followed by dermatitis to duty under treatment.	First.....	.7	1	-----	None recorded....	4 hours..	(?)

SULPHARSPHENAMINE

None.....	Sixth.....	(?)	70	(?)	None recorded....	(?).....	72
First course, July 1 to Aug. 26, 1926; second, Sept. 15 to Oct. 6, 1926; third, Apr. 7 to May 5, 1927; fourth, Aug. 25 to Oct. 12, 1927; fifth, Feb. 2 to Mar. 22, 1928, followed by dermatitis with 85 sick days; sixth, Apr. 1 to May 11, 1929; seventh, May 16, to July 18, 1929.	Fifth.....	2.0	28	71	4 injections of bismuth salicylate.	(?).....	44

It will be noted that in all but three of the neoarsphenamine cases there is a history of recent prior injection of 4 to 9 doses in varying amounts over periods ranging from 12 to 64 days. In some of the cases mercury, bismuth, or potassium iodide had been given as concurrent treatment, and in others no concurrent treatment was recorded. Two of the three cases having less than four injections of neoarsphenamine in the current course of treatment had had dermatitis exfoliativa previously. One of these had 30 sick days following the sixth injection of his first course given in March, 1928, and again 100 sick days following a single 0.2-gram dose of arsphenamine given in August, 1928. On March 12, 1929, a single injection of 0.45 gram of neoarsphenamine reproduced the condition for which the patient had 56 sick days. In the other case arsenical dermatitis had followed a third course completed November 6, 1928, and the condition was again produced by 0.7 gram of neoarsphenamine given April 30, 1929.

The 19 cases of exfoliative dermatitis which occurred in 1929 represent approximately 1 case for every 167 cases of syphilis treated. The 43 fatal and nonfatal cases which occurred during the three years 1927-1929 represent approximately 1 case for 234 cases of syphilis treated and 1 death for 2,512 cases.

Clinical manifestations in pronounced cases of dermatitis exfoliativa.—Including the 2 sulpharsphenamine cases, there were 17 cases

that may be considered severe. In three of these a dose of neoarsphenamine was injected after the appearance of a rash or eruption, presumably caused by arsenic already administered, and two cases had one or more previous attacks of arsenical dermatitis. In one case acute reactions followed each of the two doses the patient received, and in another case an acute reaction followed the first dose, with two more acute reactions during the course of six doses, the dermatitis following the sixth dose. In one case dizziness and headache followed the fifth injection and treatment was stopped, though the case later developed dermatitis. Two cases were being treated for scabies, and it was at first thought that the skin condition was due to the ointments used. In the other seven cases the dermatitis began and progressed to exfoliation without premonitory symptoms or signs.

Signs and symptoms noted at the time of onset or early in the course of the dermatitis were as follows:

Neoarsphenamine.—Rash of dry, red, itching, smarting, and burning character; dermatitis of abdomen later involving chest; erythema of face, followed two days later by red papular lesions; dermatitis of flexor surfaces of body, especially arms, forearms, hands, thighs, and eyelids also involved; general edema of skin and marked swelling of lips and face; nausea, weakness, vomiting, diarrhea, followed four days later by papular exfoliating rash on face, chest, shoulders, arms, and hips; slight macular symptomless rash on arms; maculopapular dermatitis of arms and neck; fever, cherry-red skin eruption, nervous tingling over entire body; swelling of right foot; rash on feet, chest, and arms; pin-point rash on chest and arms; eczematous condition of lower extremities; dermatitis resembling Rhus poisoning; slight puffiness under eyes and dry scaly itching affection of entire body surface.

Sulpharsphenamine.—Scaly papular rash, rupial in some spots over entire body, including face, mouth, palms of hands, and soles of feet, with pain over both tibiae; seborrheal eruption about ears, scalp, and hands, which later spread under arms, about neck, over legs, genitalia, buttocks, and abdomen. The dermatitis was local or general and of varying character even in the same case—scaly and dry with cracks or moist (weeping), macular, papular, vesicular, bullous, etc. Later manifestations include: Fever; edema of face, neck, eyelids, ears, feet, and ankles; injected conjunctiva; discharging ears; injected pharynx; enlarged and protruding lingual papillae; stomatitis; suppression of urine; anemia; leucocytosis; eosinophilia; semistupor; weakness; headache; intense itching and exfoliation.

No cases of dermatitis attributable to *arsphenamine* were reported in 1929.

Neoarsphenamine cases.—A patient infected in January, 1929, was given his first course of six weekly injections of neoarsphenamine.

mine and mercury. Doses and dates were not stated on the report. A mild exfoliative dermatitis followed the fifth weekly injection of neoarsphenamine in which the skin broke out with a dry, red, itching, smarting, and burning rash, which later began to peel with fine branny desquamation. Following the sixth weekly injection, the rash continued and the symptoms became aggravated. The skin was dry and cracked in places and very itchy. The eyes became puffy and feet and ankles swollen. The patient was transferred to a naval hospital on May 20, 1929, for treatment, receiving a total of 12 doses of sodium thiosulphate intravenously, and Fisher's solution by proctoclysis, and was reported recovered July 20, 1929.

A patient infected about the middle of April, 1929, was given his first course of treatment ending July 15, 1929. It consisted of nine injections of 0.9 gram of neoarsphenamine each twice a week. After the eighth injection a dermatitis appeared on the abdomen, later involving the chest. After the ninth injection the rash became generalized over the whole body with severe itching and burning. A week later the patient developed a generalized edema of the face and neck, the chin and neck being enormously swollen. The pharynx was covered with minute vesicles and the papillae of tongue were large and protruding. He was transferred to a naval hospital for treatment on July 29, 1929, and by November 1, 1929, had completely recovered.

A man infected in May, 1929, exhibited a typical chancre, dark field examinations of which were repeatedly positive. His first course of treatment was given from May 29 to August 1, 1929, and consisted of one 0.3-gram dose and eight 0.6-gram doses of neoarsphenamine, and nine 0.6-gram doses of mercury by injection. There was no acute reaction, but about seven days after the last dose of neoarsphenamine a slight erythema appeared on the patient's face, followed two days later by red papular lesions. August 16, 1929, he was transferred to a naval hospital, with erythema of face, itching of skin, moist scales over affected parts, arsenic in urine, ears draining pus, conjunctivae injected, and symmetrical papular eruption over nose, brow, and hands. There was also a small area on left side of abdomen. Kahn was negative. Urine was negative for albumin. October 14, 1929, the discharge from the dermatitis of external canals had ceased and the patient was feeling well. Contrary to standing injunction in the presence of such reactions, this patient was given further treatment. During the period January 29 to February 11, 1930, he received mercury by inunctions and potassium iodide internally. Between the latter date and April 3, 1930, he received nine 0.45-gram injections of an arsenical compound (probably neoarsphenamine, but entered under the general heading of salvarsan) and nine 0.6-gram injections of mercury. No further

manifestations were reported as having occurred during or after this second course.

A case in which extensive dermatitis followed two injections of neoarsphenamine occurred in 1929. The patient, a mess attendant, was given an injection of 0.9 gram of neoarsphenamine on December 20, 1929, which was followed by a severe reaction. Thirty-seven days later, on January 31, 1930, he was given an injection of 0.6 gram of neoarsphenamine, which was followed by a slight reaction. As no report was submitted on these two reactions, the nature of the symptoms is not known. However, by February 16, 1929, the patient had developed an extensive dermatitis, involving chiefly the flexor surfaces of the body, most marked on arms, forearms, hands, thighs, and eyelids. Sodium thiosulphate, amount and number of doses not stated, and sodium bicarbonate baths and soothing ointments were the treatments given. The patient returned to duty April 26, 1929, after 69 sick days.

A case in which repeated attacks of exfoliative dermatitis followed five intravenous injections of neoarsphenamine was reported in 1929. The patient, a Filipino mess attendant, reported to the sick bay with a typical indurated chancre on his lip in 1928, dark field examination of which was positive. He later developed a typical and extensive secondary rash which responded definitely to treatment. There was no history of any previous treatment with arsenicals, and his first course began on October 19, 1928, with an injection of 0.3 gram of neoarsphenamine. This was followed by 0.6 gram on October 26, 0.6 gram on November 2, 0.6 gram on November 13, and 0.6 gram on November 20, 1928. There was no reaction associated with any particular injection, except that he complained of headache and dizziness after the fifth injection, and treatment was discontinued. December 3, 1928, the patient developed a generalized edema of the skin and a marked swelling of the lips and face. The skin was indurated and brawny. His temperature was 99.8° F. on admission, and rose irregularly to 104.4 on December 5, then dropped with range about 100.5 by December 10, 1928. Urinary output gradually lessened until December 7, 1928, when only 25 c. c. was passed; then gradually increased the next two days. Urine on December 10, 1928, was negative for albumin and casts. The patient appeared seriously ill and was restless and semi-stuporous. December 7, 1928, he was given sodium thiosulphate intravenously in 1-gram doses at 10 a. m., 1.30 p. m., and 6 p. m., and again on December 8 at 11 a. m. The temperature was reduced. Additional treatment consisted of dietetic restrictions, hot packs, elimination by bowel. His condition was unchanged on December 10, 1928, when he was transferred to a naval hospital. At that time the patient showed a profound dermatitis in the stage of general

desquamation. Blood count: Reds, 3,800,000; Hgb., 65 per cent; polys, 76 per cent; eosinophiles, 11 per cent; white blood count, 26,200. From then on until his complete recovery in May, 1930, about 18 months later, he had an up-and-down experience, with periods of relative well-being and of distressing and varied symptoms. These were largely affections of the skin and superficial tissues, although his general condition suffered as indicated by anemia and recurring fever. Repeated tests were Kahn negative. The longest interval between manifestations of the reaction was 11 months following his first discharge to duty on May 8, 1929. Thereafter his discharge to duty and return for treatment of relighted symptoms, including fever, dermatitis, edema and adenopathy, etc., were repeated. This was in spite of the fact that he had received no neoarsphenamine since his fifth injection and no anti-luetic treatment of any kind after the bismuth and mercury treatment of January 7 to February 26, 1929.

A man who had been exposed in Managua, Nicaragua, on October 25, 1928, developed a primary lesion December 23, 1928, and showed a 4 plus Wassermann on January 17, 1929. The record of the course of treatment then instituted was not available when the report of reactions was made, but the patient stated that his first injection was a full dose of neoarsphenamine, followed by a few more doses. A reaction followed the first dose in which the patient felt "pretty sick." A few more injections were given, when the treatment was discontinued on account of further reaction. He was admitted to a hospital in Panama with diagnosis of ulcerative stomatitis, syphilis, and nephritis. Arsenical treatment was resumed at this hospital, and the reaction described below followed his sixth injection of neoarsphenamine, which was given on March 7, 1929. Weakness, nausea, vomiting, and diarrhea were the initial symptoms. The condition persisted and the patient was unable to retain food. On March 11, 1929, the skin of the face, chest, shoulders, arms, and hips began to break out with diffuse papular exfoliative rash which itched and burned. This was accompanied by edema of face, feet, and ankles. March 18, 1929, he was transferred to hospital for treatment. There was still some swelling of the ankles, alopecia, atrophic changes in the nails, and exfoliation of skin, but the general condition was good and there was no evidence of gross kidney damage. Kahn was negative. By July 29, 1929, patient had so improved in all respects that he was returned to duty.

A man who had been exposed in San Francisco, Calif., about September 9, 1929, developed an initial lesion, a generalized adenopathy, and a strongly positive Kahn serum reaction. His first course of treatment began on October 3, 1929, with a 0.45-gram

injection of neoarsphenamine, followed by 0.45-gram injections on October 7, 12, 16, 20, 24, 28, and November 1, 1929. After the seventh injection, which was given on October 28, 1929, the patient developed a slight rash on the arms. It did not appear as a dermatitis, but was macular in character and symptomless. Two days after the eighth injection, which was given on November 7, 1929, his temperature was 102° F., pulse 80, and respiration 24. There was also slight weakness, moderate headache, and edema of face. Signs of improvement appeared after the eighth day, but he relapsed and ran a moderately stormy course, with temperature as high as 103° F. (never below 99° F.), pulse 90 to 100, respiration 22, conjunctivitis, and edema of the face. The urine was negative for albumin and casts throughout. When he was transferred to a naval hospital December 16, 1929, his temperature had been normal for 18 days, but a slight dermatitis had persisted and there was a fine general desquamation of skin. This man was still under treatment at the hospital on March 17, 1930, when a medical survey was held in his case, report of which reads: "He has completely scaled several times. Under treatment he has gradually convalesced, and is now able to be up and about. However, he is not yet considered fit for duty, and should be retained in the hospital for about another month."

A man who had been exposed in Shanghai, China, on July 29, 1929, developed an initial lesion August 21, 1929, and a strongly positive Kahn test on October 15, 1929. His first course of arsenicals began on November 18, 1929, with an injection of 0.45 gram of neoarsphenamine, followed by 0.45-gram injections on November 22, 26, and 30. Prior to the arsphenamine injections he had received three intramuscular injections of bismuth bitartrate in $\frac{1}{5}$ -grain doses during the period October 22 to November 16, 1929. Four days after the fourth injection of neoarsphenamine the patient developed a maculopapular dermatitis on the arms and neck. On December 8, 1929, there was a mild burning and itching exfoliating dermatitis on the arms, trunk, neck, and face, with some swelling of face. The temperature never rose above 99° F. up to the time of transfer to hospital, and the pulse was usually around 100. Urine was negative for albumin and casts. He was transferred to a naval hospital on December 1, 1929, and was still under treatment there on March 17, 1930, when a medical survey was held in his case, report of which reads: "He was scaling on entry and has scaled several times. There was puffiness of lids and swelling of face, hands, and legs. This condition has all disappeared, but there yet remains a mild infection of both eyelids which is responding well to treatment. Further treatment is indicated for about one month."

A case of exfoliative dermatitis followed an injection of 0.45 gram of neoarsphenamine given March 12, 1929. The report on the reaction was incomplete, but the medical history is available. It reveals the fact that this 1929 reaction was the third attack of exfoliative dermatitis following arsenical treatment. The patient had two severe reactions in 1928, the second only being reported, and then without reference to the first. An account of the second reaction, which followed an injection of 0.2 gram of arsphenamine in August, 1928, appears on page 691 of the *BULLETIN* for July, 1930, and includes the following statement: "The report of this case included a statement that the patient was given no drugs other than those mentioned. It seems incredible that 0.2 gram of arsphenamine should have given rise to the dermatitis." Of course, at this time nothing was known of the patient's intolerance for arsenicals, as would seem to be indicated by the unreported first reaction. An account of the first reaction is given in the medical history. The patient had contracted syphilis in Shanghai, China, in October, 1927. The record shows that he received eight injections of neoarsphenamine between January 4 and March 13, 1928, and daily inunctions of mercury. He was admitted to the sick list on March 14, 1928, with a general dermatitis which had followed the sixth injection of neoarsphenamine. The mild erythema with induration which at first characterized the exanthem later passed through various phases. There was some "weeping," especially of back and chest, with slight toxic symptoms. Then in the process of scaling entire coats of fingers and feet came away, itching was troublesome, and the lesions assumed a pustular form. Temperature was 99° to 100° F.; urine negative. On April 13, 1928, he had practically recovered and was sent to duty under further treatment. In July, 1928, he received eight 0.13-gram doses of bismuth salicylate. August 22, 1928, his second reaction occurred following an injection of 0.2 gram of salvarsan. This reaction is described in the reference given.

The reaction recorded in 1929 occurred following an intravenous injection of 0.45 gram of neoarsphenamine given on March 12, 1929. The patient had been receiving mixed treatment of potassium iodide and mercuric sublimate (period not stated). About five hours after this injection the patient's temperature rose to 103° F., a cherry-red skin eruption appeared, and there was nervous tingling over entire body. The patient was transferred to hospital, where on March 31, 1929, after some exfoliation and marked general improvement (Kahn test negative), there was some return of dermatitis on the hands, arms, and feet. By April 28 the dermatitis had disappeared and the skin was more normal in consistency. At this time the only complaint was that the hands were tender, and close examination showed

scattered breaks in the superficial skin and atrophic changes of the finger nails. A few days later he was regarded fit for duty.

A case was exposed about January 20, 1929, at Tientsin, China, just prior to expiration of enlistment. About two months later a sore appeared on the shaft of penis, but the patient did not know that it was luetic until it was discovered at the time of his examination for discharge on March 27, 1929. In addition to the penile sore there were mucous patches and left epitrochlear and posterior cervical lymphadenitis. Dark field examination of the mucous patches on the uvula was positive for *Treponema pallidum*; that of the penile sore was negative. The patient was transferred to a naval hospital, where he received his first course of neoarsphenamine, as follows: March 28, 0.3 gram; April 1, 0.45 gram; and April 4, 1929, 0.6 gram. No other treatment was reported. On the night of April 5 the patient had chills, and the next day there was a red rash over the body, the face had become edematous, the eyes injected, and a small hemorrhage had appeared in each conjunctiva. Sodium thiosulphate in 1-gram doses were given at 12 m. and 6 p. m. on April 7, and again at 8 a. m. on April 8. On this latter date the rash was practically gone, though some injection of the throat remained. On April 16 he was sent to duty, symptom free.

A man 42 years of age and with about 25 years' service was admitted to the sick list complaining of poor vision. There was no evidence of recent syphilis, but there were repeated 4 plus positive Kahn tests from April 22 to March 17, 1929. Hoarseness, amblyopia, myocarditis, and glossitis were present and were considered manifestations of the syphilitic infection. There were also T. B. X-ray findings. This patient received a course of treatment consisting of 6 injections of neoarsphenamine (doses not stated) and 12 mercury rubs from April 18 to July 5, 1929. His second course began July 30, 1929, with 0.45 gram of neoarsphenamine, followed by six weekly injections of 0.6 gram each, a total of 4.05 grams for the second course, which was completed September 10, 1929. During this time the patient received daily mercury rubs and an unknown amount of potassium iodide. Eighteen days after the completion of the second course the right foot and leg became edematous and there was an exfoliative dermatitis of the whole body. Sodium thiosulphate was administered intravenously, and by November 2 the patient was considered recovered and returned to duty.

A man received two courses of treatment from February 2 to July 27, 1928, consisting of 15 doses of arsphenamine in 0.2 to 0.4 gram amounts. He received his third course from September 25 to November 6, 1928, which consisted of seven 0.9-gram doses of neoarsphenamine, and on November 20 a definite arsenical dermatitis developed. The patient was not admitted to the sick list, but re-

ceived treatment while performing his regular duties. This reaction was included in the 1928 group, and no further treatment was recorded until April 30, 1929, when an injection of 0.7 gram of neoarsphenamine was given. This first dose of the fourth course was followed in four hours by a sharp reaction in which there were headache, nausea, vomiting, fever, chills, congested face and eyes, and abdominal distress, followed by slight exfoliation on hands. One gram of sodium thiosulphate was given at 7 p. m., six hours after the injection, with amelioration of symptoms. The patient was able to return to duty three or four hours later. His further treatment, consisting of 20 injections of bismuth salicylate and four injections of tryparsamide and potassium iodide, from September 27 to December 27, 1929, was without manifestations.

A patient in a naval hospital gave a 4 plus Kahn test on July 22, 1929. Infection had occurred in 1909 or 1910, but there was no record of previous antisyphilitic treatment. He received 0.45 gram of neoarsphenamine on August 19, 1929, followed by seven weekly injections of 0.6 gram each. During this period he took daily inunctions of mercury and daily increasing doses of potassium iodide. One day after the last dose of neoarsphenamine a rash developed on feet, chest, and arms, which spread over the entire body and assumed the characteristics of arsenical dermatitis, becoming more severe in the areas first affected. Later large blebs developed on the feet and there was marked edema of the ears and about the eyes. The urine was negative for albumin and arsenic. The generalized exfoliation with itching, which began October 25, was complete and the edema and other symptoms had subsided six days later. He had practically recovered by November 25, 1929.

A man infected in Kowloon, China, was given his first course of neoarsphenamine as follows: March 22, 0.225 gram; March 26, 0.45 gram; April 2, 0.9 gram; and April 9, 1929, 0.9. One day after each injection of neoarsphenamine 1/5 grain of bichloride of mercury was given intramuscularly. April 10, 24 hours after the fourth injection of neoarsphenamine, the patient reported with a fine pin-point rash over chest and arms. His temperature was 99.5; white blood count, 12,800; polys, 50 per cent; S. L. 28 per cent; L. L., 21 per cent; baso., 1 per cent. The urine was negative. The next day the temperature rose to 102 and the patient complained of sore throat. The rash had become generalized and was measly in character. At the end of a week the rash had faded and the temperature dropped to normal. On April 17, 1929, the temperature rose to 102.6 and a scarlatiniform eruption appeared. During the following week there was a typical exfoliative dermatitis with edema of ankles, conjunctivitis, and stomatitis. Improvement under treatment was steady, and the patient had recovered by May 17, 1929.

A man infected in China in 1927 received two courses of neoarsphenamine as follows: October 19, 1927, to January 4, 1928, nine injections, average dose 0.6 gram, and daily inunctions of mercury; March 7 to April 26, 1928, eight injections, average dose 0.6 gram, and daily inunctions of mercury. The third course was given from March 15 to May 16, 1929, and consisted of eight 0.9-gram doses of neoarsphenamine given one week apart and daily mercury inunctions. On April 25 he was admitted with scabies of the groin, thighs, and buttocks and treated with sulphur ointment. This condition cleared up promptly, but returned after an interval of 17 days and was again treated with liberal quantities of sulphur ointment rubbed in vigorously. May 24 an eczematous condition over lower extremities appeared, but did not spread above waist line. The urine was negative and there had been no acute symptoms of arsenic poisoning, so that the rôle of the antiluetic treatment in the condition was questionable. The excessive use of sulphur ointment was held responsible and discontinued. He was given a diagnosis of dermatitis (chemical sulphur) and transferred to a naval hospital for further treatment. On May 25 there was an angry confluent eruption on trunk below nipples and on the abdomen, thighs, knees, ankles, and penis. Later this extended to the arms. The skin was crusted, scaly, and weeping. The urine negative. June 3 the diagnosis was changed to poisoning, arsenical, antisyphilitic, and examination of the blood later in the month showed: White blood count, 33,000; polys, 84 per cent; lymphocytes, 9 per cent. On July 1, as a test, sulphur ointment was again used. The result was a marked exacerbation of the rash on the arms. The treatment was magnesium sulphate dressings and sodium thiosulphate intravenously. By July 8 the patient had received 76 grams of the latter. The eruption was clearing rapidly, but general recovery was interrupted on July 15 by the development of otitis media on left side. Daily intravenous injections of sodium thiosulphate were continued until August 3, 1929, when local and general conditions were much improved, and on September 6, 1929, the patient was returned to duty.

A man infected in November, 1928, received his first course of arsenical treatment from November 22, 1928, to January 12, 1929, and his second course from February 7 to February 28, 1929. The number of injections in each course and the size of doses were not stated on the report. On March 3, 1929, he was admitted to the sick list, with a severe dermatitis resembling Rhus poisoning, considered due to too vigorous treatment of scabies with an ointment of creolin and balsam of Peru, but probably also associated with arsenicals. It was not possible to determine whether one or the other or both

together were responsible. The dermatitis much resembled an arsenical dermatitis in its nature and distribution, and sodium thiosulphate intravenously was given, together with calamine lotion locally. The patient was returned to duty April 16, 1929, after 39 sick days.

A man infected in Peiping, China, in September, 1929, received his first course of treatment from October 15 to December 5, 1929, as follows: October 15, 0.3 gram neoarsphenamine; October 17, 0.45 gram; October 24, 0.6 gram; October 31, 0.75 gram; November 7, 0.9 gram; November 14, 0.9 gram; and November 21 and 26, 0.9 gram, and nine 1-grain intramuscular injections of mercury salicylate. One week after the last dose of neoarsphenamine there were itching of skin, slight puffiness under the eyes, and a dry scaly condition of entire body. The case was reported as a typical case of dermatitis exfoliativa. Sodium thiosulphate was injected intravenously and also given by mouth and applied locally. Sodium bicarbonate baths and colloid baths were also given. All skin symptoms gradually subsided, and the patient was returned to duty on February 16, 1930.

Sulpharsphenamine cases.—A man infected October, 1928, at San Diego, Calif., was given one course of sulpharsphenamine of six injections from October 31, 1928, to January 9, 1929. Dosage was not stated on the report. On January 9, 1929, he was transferred to a naval hospital under diagnosis of syphilis with what was described as a scaly papular rash, rupial in some spots, over entire body, including face, mouth, palms of hands, and soles of feet. The rash which had begun one week previously became steadily worse and itched continually. There was also marked pain over both tibiae. On January 16, 1929, the diagnosis was changed to acute sulpharsphenamine poisoning. Sodium thiosulphate was given in 1-gram doses on January 9, 10, 11, and 12 and the case cleared up rapidly.

A man was first infected in Los Angeles, Calif., during June, 1926. A dark field examination was positive and the patient was admitted with syphilis on July 24, 1926. From July 1 to August 26, 1926, he received his first course of arsenicals and from September 15 to October 6, 1926, his second course. On December 20, 1926, he was admitted with a diagnosis of measles, and no further treatment was recorded until April 7, 1927, when he began his third course with 0.5 gram neoarsphenamine. This was followed by 0.9-gram doses on April 14, 21, 27, and May 5, 1927, and a fifth course from February 2 to March 22, 1928. Following the last 0.9-gram intravenous injection of neosalvarsan on March 22, the patient returned to the sick bay with puffy eyelids and urticarial-like blotches on the skin. This eruption spread to scalp, arms, trunk, and thighs and presented the appearance of an exfoliative dermatitis of arsenical origin. Treatment consisted of local soothing lotions and sodium thiosulphate intravenously on successive days between April 2 and 5 and resulted in a marked clearing of the condition.

On April 9 the patient suffered an exacerbated return of the condition and treatment was reinstituted. On April 17 he was transferred to a naval hospital for further treatment. The body was covered with dry scales on a red base. There were numerous abscesses on the face and in axillae which had to be opened; slight fever; and albuminuria. The Kahn test was negative. His recovery was progressive, and on July 7, 1928, he returned to duty. This man was discharged from the naval service, by reason of expiration of enlistment, August 10, 1928, and his records forwarded to the bureau. He reenlisted and was later reinfected in Panama, February 21, 1929. His first course after reinfection was his sixth course of arsenical treatment. He received this course (presumably neoarsphenamine) from April 1 to May 11, 1929, and a seventh course from May 16 to July 18, 1929, with 15 injections of bismuth salicylate, 0.2 gram given biweekly. On August 8, 1929, he began a course of sulpharsphenamine (his eighth course of treatment since the first infection). He had received 0.4 gram injections of sulpharsphenamine, given on August 8, 15, 22, 29, and September 5, 1929, and four injections of bismuth salicylate, when a seborrheic eruption was noted about ears, scalp, and hands. Treatment was discontinued. The eruption spread and patches were noticeable under arms, about the neck, over the legs, genitalia, buttocks, and abdomen. He was transferred to a naval hospital ship for treatment and on October 1, 1929, was given a diagnosis of acute sulpharsphenamine poisoning. Under treatment his recovery was uninterrupted, and, although there were lingering eczematous lesions on the backs of the hands and about the lobes of the ears, he was returned to duty under treatment on November 14, 1929. Kahn test was negative.

MISCELLANEOUS EFFECTS FOLLOWING THE ADMINISTRATION OF ARSENICAL
COMPOUNDS

Damage to the liver.—A death from acute toxic cirrhosis of the liver occurred on September 25, 1929, or 44 days after the fourth injection of neoarsphenamine, administered during the third course of treatment for a luetic infection. This case is fully described in the UNITED STATES NAVAL MEDICAL BULLETIN of April, 1930 (p. 506).

The only other case to be classed under this heading that occurred during the year 1929 was that of a patient who was admitted to the sick list with an initial lesion of the coronal sulcus which on dark field examination showed the presence of *Treponema pallidum*. He was given neoarsphenamine as follows: January 25, 1929, 0.45 gram; January 30, 1929, 0.6 gram; February 6, 1929, 0.6 gram. Reaction followed this third injection and was described as slightly febrile with transient vasomotor disturbances, followed a week later by

severe jaundice. Sodium thiosulphate 0.6 gram given intravenously, and iodides prescribed. Fats and meats eliminated from the diet. The jaundice cleared slowly, and by March 8, 1929, had disappeared. The patient was discharged to duty on March 12, 1929, 34 days after the last dose of neoarsphenamine. Kahn test was negative at time of discharge.

Aplastic anemia.—There were two deaths reported from this cause during the year 1929.

A death from anemia of an aplastic type occurred on June 1, 1929. This case is described in detail in the UNITED STATES NAVAL MEDICAL BULLETIN of January, 1930 (p. 243).

The second death from pernicious anemia, aplastic type, occurred July 30, 1929. The patient was originally infected in Honolulu, T. H., in May, 1928. The initial lesions appeared on August 8, 1928, a rash on August 23, 1928, and general glandular enlargement and Kahn 4 plus on August 28, 1928. From August 30 to October 11, 1928, he received 12 injections of neoarsphenamine of 0.45 gram each; from February 6 to May 1, 1929, eight injections of 0.45 gram each. He also received three 0.1-gram doses of potassium bismuth tartrate (dates not stated). The patient was admitted to a naval hospital while on leave from his ship, on July 22, 1929, and was first carried under the diagnosis of pyorrhea alveolaris. There had been bleeding gums for eight days previous to admission to the hospital. Examination revealed the following: Skin hot and dry; left posterior cervical glands enlarged; tonsils submerged and anterior pillars injected; larynx injected; gums retracted and covered with small clots of blood; several small ulcers; some dental caries; liver extended two finger widths below the costal margin; positive Vincent's angina. Blood examination showed: Red blood count, 1,540,000; leucocytes, 2,000; Hgb., 45 per cent; neutrophils, 13; lymphocytes, 87; platelets practically absent. July 24, 1929, the patient was very anemic. There were small palpable lymph glands in cervical, axillary, epitrochlear, and inguinal regions. Liver four fingers down. July 25, 1929, the diagnosis was changed to anemia, pernicious. The Kahn test was negative. Petechia appeared in the skin of chest. Purpuric spots developed rapidly over the body, especially the upper abdomen, but also on hands, and subconjunctival hemorrhage and bleeding from the mouth occurred. He became progressively worse, and died at 1.45 on July 30, 1929. The autopsy findings were: Aplastic pernicious anemia; chronic adhesive pleuritis; acute hemorrhagic broncho-pneumonia. The pathological diagnosis of a section of the liver was: Acute parenchymatous degeneration.

Polyneuritis.—We have included under this heading a case believed to have manifested symptoms of polyneuritis though the

blood picture seems to indicate injury to the leukopoietic element of the bone marrow with a beginning aplastic anemia.

On admission, March 20, 1929, the patient complained of sore throat. Examination showed the right tonsil and soft palate covered with patches. He denied venereal disease and had no scars. The temperature was 97.9° F. at this time. He was transferred to a naval hospital, where, except for the above and a 4 plus Kahn, examination was negative. The thin white exudate which formed the patches could be easily removed and resulted in bleeding only on the palate.

Prior to admission to the hospital the case was diagnosed diphtheria because of the appearance of the tonsil and palate, and a 20,000-unit dose of diphtheria antitoxin was given, but in view of the laboratory and later clinical findings the diagnosis was changed to syphilis. On March 23, 1929, he was given 0.5 gram neoarsphenamine intravenously; March 26, 0.75 gram; and April 2, 0.75 gram. The evening of the next day the patient had chills and fever (102° F.), with nausea and vomiting. These symptoms quickly subsided, but were immediately followed by a rash over the entire body which became confluent and faded with equal promptness. On April 9 a fourth injection of neoarsphenamine 0.75 gram was given. No immediate reaction was noted, but seven days later the patient felt ill. The temperature was 103, pulse 94, and respiration 20; the eyes were markedly injected and chilliness was complained of. In the absence of other assignable cause and in view of the previous record together with a white blood count of 4,800, the condition was considered due to arsenic poisoning by neoarsphenamine, and the diagnosis was changed on this date accordingly. Blood examination at this time showed: White blood count, 6,700; neutrophiles, 11 per cent; lymphocytes, 74 per cent; eosinophiles, 1 per cent; mononuclears, 14 per cent. The urine was negative for albumin, but contained arsenic. Improvement in all symptoms followed treatment with sodium thiosulphate, and by April 19 the blood picture had changed—Red blood count, 4,450,000; white blood count, 10,800; Hgb., 79 per cent; neutrophiles, 41 per cent; lymphocytes, 52 per cent; eosinophiles, 3 per cent; basophiles, 1 per cent; mononuclears, 3 per cent; platelets 220,000 and reticulates less than 0.5 per cent. On this date the patient complained of painful joints (shoulder, elbows, hips, knees, and ankles), which cleared up under salicylate medication, but salicylates were continued and physiotherapy instituted with benefit. By May 20 all acute symptoms had disappeared and a month later the patient was sent to duty. The medical officer notes that it was quite possible the neuritis was due to arsenic.

Damage to kidneys.—No cases occurred during 1929 that could definitely be classed under this heading. In a few cases discussed under the above headings there was blood, albumin, or casts in the urine, and in one case there was mention of pain in the kidney. Urinalysis findings were not included in the report of this latter case. As very severe cramplike pain in the lower back may occur in "nitritoid crisis," this case was classified under vasomotor phenomena.

Herxheimer reactions.—While some of the cases included above under vasomotor phenomena may have been Herxheimer reactions, the symptoms recorded did not indicate that inflammatory conditions had been produced in syphilitic tissues nor that there was a flare-up of syphilitic symptoms. Therefore, there are no cases to be included under this heading for 1929.

Reactions of minor importance.—In addition to the 56 cases classified above, there were 10 reactions, the reports of which do not furnish sufficient data for classification.

Eight mild reactions occurred on the same day aboard the same ship following the administration of neoarsphenamine. The reporting medical officer stated that definite information had been procured that dietary indiscretions were indulged in by the men before administration of treatment, though it was denied at the time.

A check of the 1929 Form F cards for cases of arsenical poisoning disclosed an admission on January 3, 1929, with two sick days, for which no definite data could be procured. This reaction is included in the mild reactions for 1929.

A patient who did not have syphilis received 0.3 gram of neoarsphenamine on September 25, 1929, and again on October 1, 1929, as treatment for Vincent's angina. The evening of the latter date the following developments presented: Malaise, fever, sore throat, and a measles type of rash over body. He was admitted with a "diagnosis undetermined" (measles) and transferred to a destroyer tender, where he remained under treatment for 28 days. No further information was received in this case.

HEALTH OF THE NAVY

The general admission rate, based on returns for January, February, and March, 1931, was 592 per 1,000 per annum, as compared with 419, the rate for the corresponding months of 1930. The median for the first quarter, as indicated by the records of the preceding five years, is 419.

The admission rate from disease was 553 per 1,000 per annum, as compared with 378, the 5-year median for the corresponding three-

months. The admission rate from accidental injuries was 40. The median or expected rate for the corresponding quarter of the previous five years is also 40.

Due to the outbreaks of catarrhal fever and influenza, the incidence of acute respiratory diseases was decidedly greater than expectancy both ashore and afloat. It was characterized variously as "more than seasonal increase," "mild epidemic," or "epidemic," according to the experiences of individual ships, ship groups, and stations.

The summary of cases is shown by the following tabulation:

	Shore stations in the United States		Forces afloat		Total	
	Catarrhal fever	Influenza	Catarrhal fever	Influenza	Catarrhal fever	Influenza
January.....	661	211	1, 027	39	1, 688	250
February.....	547	65	680	597	1, 227	662
March.....	443	89	846	465	1, 289	554
Total.....	1, 651	365	2, 553	1, 101	4, 204	1, 466

These totals represent wide "place" distribution, so that in only a few instances were the numbers of cases or concentrations of admissions such as to indicate occasion for the special report required, although the monthly sanitary report from many sources included some comment in the discussion of communicable diseases.

Among the shore stations, the United States naval training station, Hampton Roads, Va.; marine barracks, Quantico, Va.; air station, Lakehurst, N. J.; and the United States naval training station, San Diego, Calif., had the largest number of cases in epidemic concentration; among the individual ships that was true of the U. S. S. *Arizona*, U. S. S. *New Mexico*, U. S. S. *Tennessee*, U. S. S. *California*, U. S. S. *Idaho*, U. S. S. *Lexington*, and U. S. S. *Saratoga*. The U. S. S. *Arizona* was on the Atlantic side and had her flare in January. The other ships were on the Pacific side and experienced their epidemics later on in the quarter. This is also true of the destroyers, battle force, the flagships (U. S. S. *Omaha*, later the U. S. S. *Detroit*), tenders, U. S. S. *Melville* and U. S. S. *Altair*, and every division of which, except 12, participated in the epidemic. So many of the U. S. S. *Pruitt's* crew were ill that she was unable to take part in maneuvers for a week.

In general the type of infection, even in those cases considered influenza, was benign and uncomplicated and without sequelae, and, as usual, the question arises, with respect to the combined total of both diseases (5,670), as to whether or not a greater proportion should have been diagnosed influenza.

All presented practically the same group of symptoms, consisting of sudden onset, chilly sensations, fever, conjunctival injection, ocular soreness, headache, general pains, and constipation. The majority of cases had symptoms of the involvement of one or another part of the respiratory tract and terminated in a state of weakness.

The decision in most instances was based upon the severity of the reaction, while in others it was assisted by a blood count and the consideration of respiratory involvement. Where there was a leukopenia or absence of respiratory involvement the diagnosis was influenza, but this diagnosis was not reserved for these clear-cut cases alone.

On February 14 the United States naval training station, Hampton Roads, Va., transferred two patients to the naval hospital, Norfolk, Va., with "diagnosis undetermined." On the same day the diagnosis of cerebrospinal fever was definitely established. Both patients were recruits and the disease terminated fatally. One recruit was 18 years of age and died three days after he was admitted to the hospital, and the other one was 20 years old and died 11 days after admission. These cases came from widely separated units and no connection between the two cases could be traced.

The United States naval training station, Hampton Roads, Va., also notified one case of scarlet fever in February and two in March. The marine barracks, Quantico, Va., reported one case of scarlet fever in January.

One case of smallpox was notified by the navy yard, Mare Island, Calif.

An ensign, 23 years of age, was admitted from the air station, Pensacola, Fla., to the naval hospital, Pensacola, with diagnosis of typhoid fever. Death occurred 11 days after he was admitted to the sick list.

The admission rate, all causes, for forces afloat was 542 per 1,000 per annum. The median rate for the first quarter of the preceding five years is 390. The increase above the expected rate was due to the epidemic of catarrhal fever and influenza noted previously in this report.

The U. S. S. *Palos* reported a fatal case of smallpox in February. The patient was a dental officer, who died 16 days after he was transferred to hospital, Hankow, China.

TABLE No. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended March 31, 1931

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	72,071	39,444	18,378	111,515
All causes:				
Number of admissions.....	9,765	6,726	2,874	16,491
Annual rate per 1,000.....	541.97	682.08	625.53	591.53
Disease only:				
Number of admissions.....	9,045	6,339	2,716	15,384
Annual rate per 1,000.....	502.00	642.84	591.14	551.82
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	4,490	4,028	1,520	8,418
Annual rate per 1,000.....	249.20	408.48	330.83	301.95
Venereal disease:				
Number of admissions.....	2,656	730	564	3,386
Annual rate per 1,000.....	147.41	74.03	122.76	121.45
Injuries:				
Number of admissions.....	717	385	158	1,102
Annual rate per 1,000.....	39.79	39.04	34.39	39.53
Poisoning:				
Number of admissions.....	3	2	0	5
Annual rate per 1,000.....	0.17	0.20	0	0.20

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended March 31, 1931

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....		8,904	1,984	81,721	1,184	17,197	525	111,515
CAUSE: DISEASES								
Primary	Secondary or contributory							
Alcoholism, acute.....	Myocarditis, chronic.....			1				
Appendicitis, acute.....	Peritonitis, general, acute.....			1				
Do.....	Peritonitis, local, acute.....			1				
Cerebrospinal fever.....	None.....			2				
Cirrhosis, liver.....	Myocarditis, chronic.....			1				
Delirium, alcoholic.....	None.....					1		
Endocarditis, acute.....	do.....		1					
Focal infection, dental.....	Pneumonia, lobar.....			1				
Gonococcus infection.....	do.....			1				
Hodgkin's disease.....	Pneumonia, broncho.....					1		
Do.....	Stomatitis, gangrenous.....				1			
Influenza.....	Pneumonia, broncho.....	1		3		1		
Do.....	Pneumonia, lobar.....					1		
Malaria.....	None.....				1			
Meningitis, cerebrospinal, acute.....	do.....			1				
Myocarditis, chronic.....	Dilatation, cardiac, acute.....	1						
Do.....	Angina, pectoris.....			1				
Nephritis, chronic.....	None.....			2				
Pneumonia, lobar.....	do.....	1	1	5		2		
Do.....	Myocarditis, acute.....			1				
Do.....	Pericarditis.....			2				
Do.....	Pleurisy, suppurative.....	1						
Septic sore throat.....	Pneumonia, broncho.....			1				
Sinusitis, ethmoidal.....	Meningitis, cerebrospinal.....					1		
Sinusitis, frontal.....	Abscess, brain.....			1				
Smallpox.....	None.....	1						
Syphilis.....	Dementia, paralytica with terminal pneumonia broncho.....	1						
Tuberculosis, chronic pulmonary.....	None.....			1				
Do.....	Pancreatitis, acute.....			1				
Do.....	Tuberculosis of epiglottis.....			1				

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended March 31, 1931—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,904	1,984	81,721	1,184	17,197	525	111,515
CAUSE: DISEASES								
Primary	Secondary or contributory							
Tuberculosis:								
Pulmonary, acute, gen- eral miliary.	Myocarditis, general.....			1				1
Acute pneumonic.....	Tuberculosis, larynx.....			1				1
Typhoid fever.....	None.....	1						1
Total for diseases.....		7	2	30	2	7		48
CAUSE: INJURIES AND POISONING								
Asphyxiation, gasoline va- por.....	None.....			1				1
Burns, multiple.....	do.....			2				
Drowning.....	do.....			8				
Seaplane crash:								
Drowning.....	Injuries, multiple, extreme.....			2				
Electric shock, injuries from.....	None.....			1				
Fracture:								
Compound, skull.....	do.....			4				4
Simple, skull.....	do.....			1				1
Injuries, multiple, extreme.....	do.....	1		2	1	2		6
Landplane crash:								
Injuries, multiple, ex- treme.....	do.....	2		2				4
Intracranial injury.....	do.....			2				2
Do.....	Pneumonia, lobar.....					1		1
Wound, gunshot, multiple.....	None.....					1		1
Wound:								
Incised—								
Neck.....	do.....			1				1
Wrist.....	do.....			1				1
Chest.....	do.....			1				1
Lacerated, neck and wrist.....	do.....			1				1
Penetrating—								
Brain.....	do.....			1		3		4
Lung.....	do.....					1		1
Poisoning, lysol, acute.....	Psychosis, unclassified.....					1		1
Total for injuries and poisoning.....		3		30	1	9		43
Grand total.....		10	2	60	3	16		91
Annual death rate per 1,000:								
All causes.....		4.49	4.03	2.94	10.14	3.72		3.26
Disease only.....		3.14	4.03	1.47	6.76	1.63		1.72
Drowning.....				.49				.36
Injuries.....		1.35		.98	3.38	1.86		1.15
Poisoning.....						.23		.04

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

Cumulative data

	Number	Per cent of recruits received	Per cent of recruits reviewed
<i>Jan. 1 to Dec. 31, 1930</i>			
All naval training stations:			
Recruits received during the period.....	9,221		
Recruits appearing before board of medical survey.....	677	7.34	
Recruits recommended for discharge from the service.....	269	2.92	39.73
<i>January, February, and March, 1931</i>			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	558		
Recruits appearing before board of medical survey.....	16	2.87	
Recruits recommended for discharge from the service.....	4	.72	25.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	922		
Recruits appearing before board of medical survey.....	29	3.15	
Recruits recommended for discharge from the service.....	29	3.15	100.00
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	984		
Recruits appearing before board of medical survey.....	3	.30	
Recruits recommended for discharge from the service.....	3	.30	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	586		
Recruits appearing before board of medical survey.....	34	5.80	
Recruits recommended for discharge from the service.....	3	.51	8.82

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations.

Dental defects.—Enlisted at New York, N. Y., March 2, 1931. Teeth Nos. 2, 5, 12, 13, 15, 19, 20, 22, 25, 26, 27, 28, 29, 30, 31, and 32 were carious. Exodontia was indicated in Nos. 12, 13, 19, 20, 29, and 31, with pulp involvement probable in others. The teeth were in unsound condition generally, due to malnutrition and metabolic disturbances in early life. Also the right testicle was atrophied. Surveyed March 6, 1931.

Enlisted at New Castle, Pa., March 2, 1931. Teeth Nos. 11, 17, 19, and 29 were missing; Nos. 3, 15, 16, 18, 20, 28, 30, and 31 were carious. There were no sound inferior molars present, and exodontia was indicated in Nos. 18, 20, 21, 29, and 31. Prosthetic treatment was indicated at the time of enlistment. There was general gingivitis and mandibular macrognathia with malocclusion. Also the candidate had marked right deviation of the nasal septum with obstruction. Surveyed March 6, 1931.

Nasal defects.—Enlisted at Uniontown, Pa., March 11, 1931. Nasal septum was very irregular, with large spurs on each side, causing serious obstruction in both nares. Variation from standing minimum height and chest measurement also noted. Surveyed March 17, 1931.

Glandular involvement.—Enlisted at Dayton, Ohio, March 2, 1931. There was definite palpable enlargement of thyroid gland, the can-

didate stating that he had been under a physician's care for the past three years. Surveyed March 6, 1931.

Enlisted at Indianapolis, Ind., February 21, 1931. There was definite enlargement of left mammary gland, with palpable milk lobules. Surveyed March 4, 1931.

Defective physical development.—Enlisted at Lawrence, Mass., March 16, 1931. Physical examination upon arrival at the training station revealed: Insufficient molars (less than four opposing), malocclusion, undescended left testicle, and infantile genitalia. Surveyed March 21, 1931.

Deformity.—Enlisted at Chicago, Ill., March 11, 1931. The faulty union of a fracture of the right femur had resulted in a deformity. There was a 12-inch scar and considerable forward and outward bowing, particularly apparent because the site of the fracture was the middle of the shaft. X ray showed an embedded broken Lane plate. The candidate also had a left direct inguinal hernia and a left flat foot. Surveyed March 11, 1931.

Loss of substance.—Enlisted at Milwaukee, Wis., February 26, 1931. Examination showed adherent scar tissue in right midaxillary line over fifth rib due to resection on account of empyema. There was slight dullness over the area and also reduced excursion of right chest on deep inspiration. Surveyed March 6, 1931.

Tachycardia.—Enlisted at Stonefort, Ill., March 18, 1931. This candidate had a definite persistent rapid heart rate. At rest it was 120; after exercise, 150. Also there was a decided curvature of the spine with 1 inch shortening of the left leg. Surveyed March 27, 1931.

ADMISSIONS FOR INJURIES AND POISONING, FIRST QUARTER, 1931

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the first quarter, 1931, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, January, February, and March, 1931	Admission rate per 100,000 per annum	Admission rate per 100,000 year 1930
INJURIES			
Connected with work or drill.....	565	2,027	2,639
Occurring within command but not associated with work.....	341	1,223	1,914
Incurred on leave or liberty or while absent without leave.....	196	703	1,535
All injuries.....	1,102	3,953	6,088
POISONING			
Industrial poisoning.....	2	7	33
Occurring within command but not connected with work.....	0	0	100
Associated with leave, liberty, or absence without leave.....	3	11	26
Poisoning, all forms.....	5	18	159
Total injuries and poisoning.....	1,107	3,971	6,247

PERCENTAGE RELATIONSHIPS

	Occurring within command				Occurring outside command	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or A. W. O. L.	
	January, February, and March, 1931	Year 1930	January, February, and March, 1931	Year 1930	January, February, and March, 1931	Year 1930
Per cent of all injuries.....	51.3	43.4	30.9	31.4	17.8	25.2
Per cent of poisonings.....	40.0	21.0	0	62.9	60.0	16.1
Per cent of total admissions, injury and poisoning titles.....	51.2	42.8	30.8	32.2	18.0	25.0

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "drug addiction" or "alcoholism," as the case may be. Such cases are not included in the above figures.

There were no cases during the first quarter of 1931 worthy of notice from the standpoint of accident prevention.

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